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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

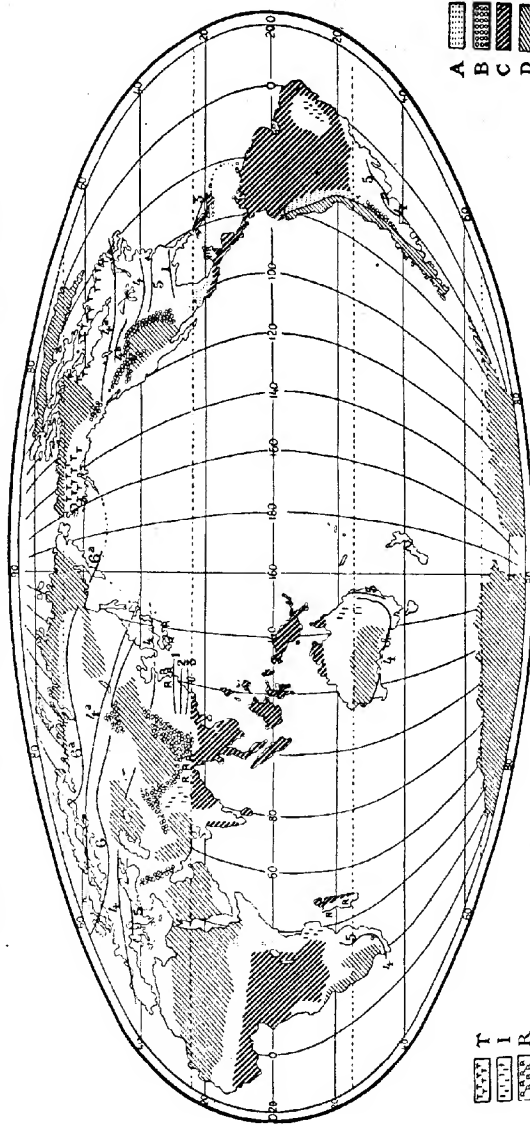
148 - White Settlement and World Agriculture — TAYLOR, G. (University of Sydney), The Institution of Future White Settlement, A World Survey Based on Physiographic Data, in *The Geographical Review*, Vol. XII, No. 3, pp. 375-402, figs. 9. New York, N. Y. July 1922.

From the point of view of white settlement there are four types of land surface which are unsuitable. These are first, the tundras of the polar regions, which are too cold for our ordinary domestic animals and so usually too dry though there is a possibility of the development of large-scale reindeer industry. Secondly, and most important, the desert regions of the world, which are too dry for agriculture though a certain amount of stock can live therein. Thirdly, the rugged mountainous regions and the high plateaus of the colder belts. In tropical regions of course the plateaus are much more favorable for settlement, but unfortunately they are not very extensive. HUNTINGTON, however, believes that most tropical plateaus suffer from the excessive monotony of their climate and the fact that the healthy *variety* of temperate regions is absent. On the other hand, BOWMAN states as regards the tropical plateaus that there are two distinct seasonal climaxes, one at the height of summer and one at the height of winter; for the plateaus of Peru and Bolivia these climaxes last for a period of about six weeks, with very important effects upon the life of the region. Fourthly, there are the hot wet regions of the tropics, where the natural resources are abundant but the climate is quite unsuited for white settlement on any considerable scale or indeed for any form of white settlement requiring constant manual labor.

In the map here reproduced these four types are given in a generalised form. The regions left blank are those suited for some form of European settlement.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

Map showing in generalized form regions suitable for white settlement and crop zones of the temperate lands.  
 Shaded areas (ruled or dotted) are more or less unsuitable for white settlement.



T = Tropical; I = Indian; W = Wheat; R = Rice.  
 A = Over 60 in. ft. temperate; B = Over 40 in. ft. temperate; C = Over 40 in. ft. Rainfall; D = Under 10 in. Rainfall.  
 S = Cotton; 2 = Tea; 3 = Sugar; 4 = Wheat; 5 = Maize; 6 = Kye; 6 a. Limit of Kye.  
 The areas shown white represent the regions suitable for the white race; the shaded portions those that are only to a greater or less degree suitable.

ocean settlement. Almost the whole of Europe and North America available, about half of Asia and Australia, and relatively small proportions of Africa and South America.

In the moderately watered tropical regions a considerable population of pastoral whites will probably develop, but in the author's opinion there is no prospect of any large agricultural settlement. In the temperate regions are inserted the zones where the most important crops thrive.

In the northern hemisphere the zones, like the chief mountain ranges, run for the most part from east to west and these zones are broken by the arid and mountainous regions. In the southern hemisphere the trend lines of the continents run north and south and the crop belts more or less follow this direction. In no case does the crop region extend to the desert areas, but a belt of stock country always occupies the margins of the desert.

The optimum of the wheat crop is near the optimum of white settlement in northern lands. In southern lands the present wheat optimum — on easily tilled prairies — is on the dry side of the optimum of white settlement.

G. A. B.

1249 — **Agriculture in Greece.** — LADAS, S., in *L'Economiste d'Athènes*, Year II, No. 29, pp. 452-555. Athens 2-15 Aug. 1922 (1).

The present condition of agriculture in Greece does not differ very much from that of the Roman period. Most cultivators still use wooden ploughs with iron ploughshares. The only other agricultural implement used by farmers is the scythe. Sowing is done by broadcasting as seeding machines are unknown. Threshing is generally done by means of horses or oxen. Threshing machines, rollers, etc., are almost unknown. Manures are seldom used; sometimes the dung of draught animals is put on the land when it is not used by the country people for fuel after drying. If the farmer owns flocks of sheep or goats, which is seldom the case, he manures his fields with their dung by letting them graze there after the harvest. It is only recently that chemical manures have begun to be used in very small quantities, to the extent of 6000 tons a year, chiefly on large estates and for special crops.

There are many kinds of cultivation and the practice of allowing land to lie fallow is often adopted in Greece, both on large and small estates. This is considered necessary to prevent soil exhaustion; but really it is of no use since it does not restore to the soil any of the substances which have been taken out of it. The only result is that the farmer restricts his crop to one half or one third of his field and deprives himself of the crop from the other half or two thirds each year. At the same time the national yield decreases. For the farmer especially the loss is certainly greater than the amount which he would spend on the regular manuring of his field, which would in that case return him a crop twice or three times as large. The rotation system is also defective and entirely a matter of rou-

(1) See *R.* Sept. 1922, No. 900. (*Ed.*)



time; it leads to the cultivation of crops which are neither the most profitable nor most suited to the nature of the soil. It leaves out of account the fact that all crops do not require the same degree of heat and moisture; a cold rainy place is suitable for growing wheat but not for barley, etc. Moreover, the kind of crop to be grown is chosen in a routine manner according to the colour of the soil, neighbouring cultivation, etc., whereas none of these indications are of great value. The choice of the crop which suits each soil and vice-versa is a matter of great importance to the future yield. Planting and sowing should be done according to the nature of the soil.

Viticulture is also very defective in Greece. Tillage is superficial; manures unknown; pruning is done hap-hazard. The use of sulphate of copper, so common at the present time, is still a matter of very great difficulty in Greece, subject as it is to all the conditions of bureaucracy and in consequence often arriving too late. The vintage takes place at a fixed time, without proper consideration of the ripeness of the grapes, because the changeableness of the weather obliges the wine-dresser to hasten the gathering of the grapes. As for wine-making and distillation, they are carried out in a very defective manner, without those modern scientific methods which enable wine to be well made and to keep well.

As regards oil-growers, they are ignorant of the most elementary rules. The olive trees receive no attention. Their owners, like the owners of other fruit trees, took them as natural gifts intended to yield fruit without any trouble to themselves. Consequently it is by no means uncommon to find that fruit trees, and especially olive trees, are attacked by various diseases which cause great loss and in some places even destroy the crop. The lack of elementary agricultural knowledge is noticeable even in the gathering of the fruit, which is not done at suitable times, as well as in the manner in which the gathering is done which causes much waste of fruit. The extraction of oil from the olives is also done in a defective way; it is mainly done by means of crushing mills worked by horses and with the greatest disregard of cleanliness. Water power oil presses are not found in Greece.

Breeding is insignificant and carelessly looked after. Generally the farmers own no animals except their draught animals (one or two oxen or horses) which, after all, form the necessary complement of agricultural economy. Such animals as there are, pass their whole life in the fields and are herded in roofless enclosures, exposed to all weathers; in winter they are very frugally fed and in consequence they are thin and weakly and of little value. Professional breeders, without the most elementary knowledge of breeding, often see their flocks and beasts of burden die without being able to help them in any way. G. A. B.

1250 - **Agricultural Experimentation in Assam during the Year ending March 31, 1922.** — MAC SWINEY, J. (Director, Department of Land and Agricultural Records, Assam), in *Report of the Agricultural Department of Assam for the year ending March 31, 1922*, 12 pp. Shillong, 1922.

Assam possesses four Agricultural Experiment Stations. These are situated respectively at: 1) Jorhat — 2) Karinganaj — 3) Upper Shillong

— 4) Shillong. An estate has been bought at Titabor for the establishment of a Rice-growing Experimental Station.

1) At Johrat, most of the experiments are carried out on high ground where the soil is a fairly compact, reddish, ancient alluvium; the sub-soil is stiff and yellowish-grey. These soils have an acid reaction and are poor in lime and phosphates, for which reason experiments in liming and the application of phosphatic manures are in progress.

The first liming experiments date from 1909; a piece of land that was limed that year is still producing good crops after 13 years have elapsed, though it is true that the yield is gradually diminishing. The adjoining unlimed field is however unsuitable for any crop.

It was found on comparing the effects of heavy applications of lime at long intervals with those of small and more frequent doses that although the heavy applications produced larger crops for the first few years, after the fifth season, the lighter and more frequent doses were superior. Excellent results were obtained with dung combined with wood ashes.

Land improved by the introduction of large quantities of ground limestone stood deep ploughing well, although deep ploughing was injurious where only a small amount of limestone had been applied.

In the Assam valleys, the soil is improved by the addition of any alkaline substance: lime, limestone, magnesium carbonate, and even sodium carbonate, especially if it is accompanied by some fertiliser. Chemical fertilisers (except superphosphates) used alone have no beneficial effect; ammonium sulphate is even injurious, since if applied several times, it tends to increase the toxic character of the soil.

The chief task of the Johrat Station is the acclimatisation, testing and selection of foreign and native varieties of sugar cane.

Manurial and rotation experiments are also made and good varieties of sugar-cane are distributed to the growers. Up to 1920, 4 varieties had been thus distributed: Striped Mauritius — B. 147 — B. 176 — J 33 a; in 1921, two others were added: Co 9 and D 74.

The yield (in tons per hectare) of stripped cane and saccharose (present in the expressed juice) in 1921, which was a good year, were as follows for the best varieties tested: B 3412, 46.5; 4.15 — D 74.42.7; 4.10 — J 247, 35.8; 3.83 — Mauritius 55, 38.5; 61 — Striped Mauritius 38.2; 3.84 — Co 9, 35.9; 4.3 — B 147, 34.8, 3.7 — A 2 a 33.9; 4.38. The varieties D 74 — G 33 a — Co 9 are distinguished by their resistance to lodging induced by wind.

2) At Karinganj, rice selection is carried on. For purposes of comparison are grown: pure line selection of 158 types of "aus" (winter rice) — 176 types of "sail" (transplanted winter rice) — 55 types of "asra" (a short-stemmed marsh variety of rice) — 343 types of "aman" (winter marsh rice for sowing broadcast).

Of the "aus" varieties, M 36-30 proved the best, and in 1921, its distribution to the rice-planters was begun. "Late sail" was the most satisfactory of the "sail" varieties. This, together with "George sail"

and "Indra sail" is cultivated experimentally on a large scale by the agriculturists of the Surma Valley.

3) The chief work at Upper Shillong is the acclimatisation, testing and propagation of the potato by "seed". Of the 24 varieties tested in 1921, King of Potatoes, British Queen, Up-to-date and Imperator produced, as in preceding years, the highest yield per hectare. These are the varieties chiefly distributed for planting.

In order to obtain a supply of "seed" for distribution, the first seed potatoes are given to expert growers who return to the Station one and a half times the number of tubers that were consigned to them, or if they wish, sell to the Station at a rather higher price all the crop suitable for planting. The seed potatoes thus obtained are sold to the agriculturists of the plain.

Of the several varieties of jute cultivated, "Kakaya Bombai" native to Bengal, has clearly proved the best. In 1921, the Station obtained two other selected varieties of Dacca jute, D 154 and Green Olitoria that will be used in a comparative experiment with "Kakaya Bombai".

Very encouraging results have been obtained from tobacco-growing in the Surma Valley. The leaf-yield of a Rangpur variety, Mathan exceeded by 380 kg. the crop produced by the local varieties.

The experiments conducted during the last three years in the Surma Valley have shown that "dhaincha" (*Sesbania aculeata*) forms an excellent green manure for the "sail" variety of rice. It should be sown immediately after the autumn-sown crop.

Two herds of cattle, one of pure-bred Patna animals, the other consisting of hybrids Patna  $\times$  Rhutia are reared separately at the Upper Shillong Farm. The improved bulls obtained are sold to the agriculturists and the demand far exceeds the supply.

4) At Shillong, experiments are in progress with fruit trees from the temperate zones. Many varieties of apple and pear trees have already been acclimatised at this Station. F. D.

1251 - Experimental Work in Progress in the Laboratories, Rothamsted Experimental Station, England. — *Current Leaflet*, pp. 1-8. Harpenden, 1922.

The investigations and experiments carried out at the Rothamsted Experiment Station, both in the laboratory and in the field are of world-wide importance. The following résumé has been made of the experiments now in progress: —

BACTERIOLOGICAL DEPARTMENT. — Main lines of work now proceeding: —

1) A study of the rapid changes in bacterial numbers in fields and their relationship to nitrate increase and decrease. The method of study consists in taking soil samples from a plot at two hourly intervals for periods up to 86 hours and estimating bacterial numbers and nitrates from each sample.

2) A study of the soil bacteria capable of decomposing phenol, cresol and naphthalene. These organisms are of importance as they form

the use of the antiseptics in soil, for the destruction of pests. The investigation comprises the geographical distribution of the organisms, their physiology, and the changes which accompany the addition of phenol to oil.

3) The influence of farmyard manure on the growth of clover and other leguminous crops and on the development of the root nodule bacteria, is being studied in pot experiments and in the field.

**BOTANICAL DEPARTMENT.** — In the Botanical Department problems relating to the nutrition and growth of plants come under consideration and are dealt with chiefly in pot and water cultures. Special attention is being directed to the effect of high temperatures and excessive sunshine on growth and also to the stimulating action that appears to be exercised by very small quantities of certain chemical substances, such as boric acid, which are poisonous in heavier doses.

The comparative effect of artificial fertilisers on meadow hay is investigated by means of detailed separations of the hay from year to year, the relative amounts of the different species varying considerably with the manure.

**SOIL CHEMISTRY.** — a) *Nitrogen Cycle.*

1) The rapid fluctuation in nitrate content of field soils and their relation to bacterial numbers (in co-operation with the Bacteriological Department).

2) The rate of nitrification of sulfate of ammonia applied to field soil as early and late top dressings.

3) The fixation of nitrogen by green algae in pure culture (in conjunction with the Mycological Department, Algology Section).

4) The development of improved methods of analysis for the study of the nitrogen compounds of the soil.

5) A survey of the total nitrogen content of the soil of certain fields.

b) *Carbon Cycle:* 1) A study of the organic matter of the soil with special reference to humic products; their mode of formation, properties, and distribution.

2) The dephenolising power of the soil, with special reference to the action of manganese.

c) *Green Manuring:* The relative value of different systems of green manuring and their effect on the nitrogen cycle and carbon cycle in the soil.

**FERTILISING CHEMISTRY.** — a) *Phosphatic Fertilisers.* — A study of the citric solubility of different basic slags and mineral phosphates and its relation to their manurial value.

b) *Potash fertilisers.* — A study of the relative manurial values of sulphate and chloride of potash, and of their effect on the soil.

**ROUTINE ANALYSIS.** — A very large number of analyses of soils, manures and plant products are made every year by the assistant staff.

**FERMENTATION DEPARTMENT.** — In the laboratory for Fermentation Work the methods for converting straw into Artificial Farmyard Manure are being studied with a view to reducing the cost of production on the large

scale. The fresh water required to wet the straw is not available in many places, but a considerable amount of surplus straw lies along the Essex creeks. Straw has been treated with sea water and found to produce a satisfactory manure although the fermentation proceeds more slowly than with fresh water.

Many types of waste vegetable material have been tested and some of these yield a richer manure than straw. The quantities available in this country are however usually very limited.

INSECTICIDE AND FUNGICIDE DEPARTMENT. — The work done in this department can be classed under two headings:

1) The study of natural and synthetic products with the main purpose of correlating chemical constitution and physical state with toxicological action on plant pests and disease organisms.

During the past two years investigations have been made on the toxicity of many chemical products to soil pests such as wireworms and eelworm both on a laboratory and large glass-house scale.

Certain plants poisonous to insects have been examined and one of them, Tuba root (1), found to be efficacious against caterpillars.

At present an attempt is being made to find a substitute for nicotine by examination of various synthetic products.

2) A biochemical study of the nature of immunity particularly with reference to Wart Disease of Potatoes (*Synchytrium endobioticum*). Attempts are being made to correlate certain biochemical and physico-chemical factors with immunity. Collateral properties, such as the boiling and cooking qualities of potatoes have a place in this research.

Various grafting experiments are being done and attempts made to find a fungicide capable of eradicating the disease.

PROTOZOOLOGY DEPARTMENT. — The investigations of RUSSELL and HUTCHINSON on partial sterilization of the soil lead to the view that in normal soil the increase in bacterial numbers was inhibited by a biological factor provisionally regarded as the soil protozoa. Recently satisfactory methods have been devised for counting these organisms and an extended experiment covering 365 days showed that an inverse relationship exists between the bacterial numbers and those of the active amoebae.

Flagellates do not appear greatly to affect the bacterial numbers, but in one species the active numbers show a two-day periodicity. The physiology of the dominant species of soil protozoa is being investigated, and a survey made of the protozoan population of soils obtained from various parts of the world.

SOIL PHYSICS DEPARTMENT. — The properties of the soil that are at present studied in this department can be broadly divided into two groups dealing respectively with the soil particles themselves, and their relations to the soil water. The first group embraces problems of soil tilth, the effect of clay and organic matter, and the colloidal properties of soil. The second

(1) *Dequella (Dorris) elliptica*. — See R. January 1920, No. 143. (Ed.)

roup includes studies of the complex relations between the soil-solution and the soil and an important investigation into the hydrogen-ion concentration of the soil-solution.

Considerable field work, involving dynamometer measurements with different implements, is done on soil cultivation, and in the meteorological section of the department observations are made on the effect of meteorological conditions on the soil.

STATISTICAL DEPARTMENT. — The statistical laboratory was founded in 1919 with a view to applying the powerful methods of analysis supplied by modern statistics to the agricultural, meteorological, and biological observations made at the Station. The Rothamsted crop weather records extend for nearly seventy years, and in accuracy as well as extent form an unparalleled body of data, for the study of the causes of crop variation. Three main causes of variation have been distinguished in the wheat yield from Broadbalk field; of these the most important is that of the weather, the very complex effects of which are in process of analysis.

INSTITUTE OF PLANT PATHOLOGY. — *Entomology Department.* — The work of this Department is divisible into 4 chief branches:

- 1) Research work on the biology of Aphides, with special reference to the Bean Aphis (*Aphis rumicis*) including factors underlying the different phases of its reproductive capacity and the relative susceptibility to attack of different varieties of broad beans and field beans.

- 2) Researches on the insect and other invertebrate fauna of the soil with particular reference to distribution in depth and the effects of manurial and other treatments of the soil.

- 3) An investigation of the relative toxicity of various chemical compounds and their possible value as insecticides (in conjunction with the Insecticide and Fungicide Laboratory).

- 4) The life-history of the gout-fly of barley (*Chlorops taeniorhynchus*), winter host and methods of control.

MYCOLOGY DEPARTMENT. — Among the investigations in progress are: 1) The numbers, distribution and functions in the soil of the fungi and microscopic green plants (*Algae*). A monograph on these organisms and their soil activities is being prepared.

- 2) The killing powers of various chemicals, heat etc. on fungi and the way in which death is brought about.

- 3) The growth of fungi in relation to various external conditions.

- 4) The changeability of fungi and bacteria in various ways such as their power of attacking plants, etc.

- 5) Various problems in connection with wart disease of potatoes, more particularly the relation of the last to the fungus and methods of getting rid of the latter from the silo.

- 6) An intensive study of the parasitic fungus *Botrytis cinerea*, which causes grey mould.

- 7) The fixation of nitrogen by green algae in pure culture (in conjunction with the Chemical Department).

M. L. Y.

## CROPS AND CULTIVATION

1252 - **The Climate of the mountainous Regions of Minas Geraes (Brazil) in Relation to agricultural and zootechnical Conditions.** — I. ALVARO A. DE SILVEIRA, in *Memoorias chorograficas*, Vol. 1, pp. 1-327. Be o Horizonte, 1921. II. FERRAZ SAMPAIO in *Boletim de Normas, Directoria de Meteorologia, Ministerio de Agricultura, Industria e Commercio*. Rio Janeiro, 1922.

In the mountainous regions of the interior of the State of Minas Geraes the lowering of the temperature which coincides with increase in altitude makes possible both extensive cattle breeding and the growth of certain temperate zone crops, such as wheat and fruit trees of the Rosaceae group.

The following Table which is a record of observations made at the Meteorological Station at Caxambu gives some idea of the special climatic conditions of the region.

*Meteorological observations made at the Caxambu Station.*

Month	Temperature			Rainfall	Nebulosity	Hours of sunbath
	mean	absolute maximum	absolute minimum			
January . . . . .	20.06 C.	32.4 C.	12.2 C.	338.3 mm.	7.6	1511
February . . . . .	20.8	33.6	9.0	177.5	6.5	1651
March . . . . .	19.6	33.0	9.8	113.8	6.4	1742
April . . . . .	18.0	28.8	5.8	95.2	5.2	2002
May . . . . .	15.1	29.0	—0.1	29.7	4.2	2101
June . . . . .	13.8	27.0	—1.6	20.6	3.9	2031
July . . . . .	13.3	29.0	—1.0	15.9	3.2	2271
August . . . . .	14.9	30.0	—1.6	23.7	4.0	2281
September . . . . .	17.9	33.6	2.0	69.2	4.3	1931
October . . . . .	19.0	32.8	3.8	150.9	6.1	1778
November . . . . .	19.5	33.2	6.6	187.6	7.1	1601
December . . . . .	19.9	32.6	7.2	215.4	7.4	631

According to this Table, the temperature often falls below 0° during winter; in the highest localities the winter is still more severe and frosts and mists are very frequent. As the sea is approached, the temperature rises and sub-tropical and tropical areas are gradually entered. The rainfall is abundant, as is the case in all other parts of this State; there is a dry season which corresponds with the coldest months.

**WHEAT.** — Apparently wheat-growing in these regions can be made to pay. Good results have been obtained at the "fazenda Cipó" in sowing on November 25 and reaping on March 20.

**MEDICINAL PLANTS.** — Throughout the interior a large number of very useful medicinal plants are found, notably: — an arboreal Euphorbia, with lobed leaves, furnishing a very powerful drug for the treatment of venereal diseases — "Gritadeira", a Rubiaceae plant of the genus *Psychotria* with yellow, tough leaves, an excellent diuretic

*Adomyrcia longipes* Berg. one of the Myrtaceæ, from the bark of which manna freely exudes — the Castor oil plant (*Ricinus communis*) grows wild and in great abundance.

FRUIT TREES. — In the high "sierras" formed of gneiss and other aldsopathic rocks their disintegration produces a soil which is very suitable for planting European fruit trees.

SILVEIRA saw at Itatiaia, at an altitude of 2000 m., pear and apple-trees laden with very fine fruit, and at Jordão (1700 m.) fairly vigorous plum trees bearing fruit.

With the financial help of the Minas Geraes Government an experimental orchard has been planted at S. Maria da Fè with pear, apple and cherry trees.

ALTITUDE LIMIT OF TROPICAL AND SUB-TROPICAL CROPS. — On the José Mariano estates ("Sierra Cipó"), mango trees bear good fruit up to 1000 m.; citrus fruits are also grown. The coffee bush flowers all the year round, but the yield is not satisfactory.

CATTLE BREEDING. — Owing to the humidity and heavy rainfall, the pastures are always green. The wild forage plants are excellent; it is sufficient to mention *Arundinaria cannavieira* Alv. Silv. the composition of which is as follows: —

Moisture . . . . .	11.72 %
Ash . . . . .	2.94
Protein . . . . .	6.93
Fats . . . . .	2.10
Cellulose . . . . .	39.73
Non-nitrogenous extracts . . . . .	36.58
	100.00

On the Cipó "sierra", in the district of Mantiqueira, breeding can be carried out successfully at between 1630 and 2000 m. G. A.

253 - Effect of Meteorological Factors on the Quality and Quantity of Wheat produced in Argentina. — HESSLING, N. A., in *Monthly Weather Review*, Vol. 50, No. 6, pp. 302-208. Washington, June 1922.

Results of a study on the relation between wheat production and meteorological phenomena in Argentina. Special importance has been assigned to rainfall and temperature.

EFFECTS OF RAINFALL. — An excess rather than a lack, of rainfall is detrimental to wheat in that part of Argentina where it is chiefly grown. The largest crops are obtained when the rainfall is nearly at its lowest, i. e. 50 to 100 mm. during the 3 winter months, and 100 to 150 mm. from September to November (see Tables I and II). Above and below this limit a decrease in yield is noticed. The decrease observed when there is an increased rainfall is not however, in proportion to this increase; there are cases when, in spite of abundant rains, a very good crop is obtained. It might be concluded from this that the decrease in yield is due less to the rains than to other meteorological factors connected with them.



TABLE I. — *Relation between grain yield (in kg. per ha.) and winter rains (June-August).*

	Millimetres of rain						
	less than 10	10-25	25-50	50-100	100-150	150-200	200-250
Number of cases . . . . .	5	6	9	16	12	3	3
Average yield . . . . .	585 kg	588 kg	671 kg	751 kg	704 kg	708 kg	631 kg
Maximum yield . . . . .	662	821	822	1070	1224	844	687
Minimum yield . . . . .	467	350	460	216	422	536	597

Up to the present the winter and spring rains have been considered in two separate groups. But from the data gathered by the writer it is evident that there is compensation between the two groups. When there are less than 25 mm. of rain during the winter, a good crop may still be obtained if the spring rains are very abundant. In other words, after a very dry winter season, the more abundant the spring rains the higher the yield.

TABLE II. — *Relation between grain yield (in kg. per ha.) and spring rains (September-November).*

	Millimetres of rain							
	25-50	50-100	100-150	150-200	200-250	250-300	300-350	350-400
Number of cases . . . . .	1	5	11	6	11	13	5	2
Average yield . . . . .	353 kg	450 kg	797 kg	687 kg	674 kg	720 kg	650 kg	751 kg
Maximum yield . . . . .	—	756	1224	909	852	989	844	860
Minimum yield . . . . .	—	216	561	556	440	501	422	642

The spring rainfall (September-November) required to ensure a maximum yield is less if the June-August fall is heavier. When the winter rainfall exceeds 100 mm., the maximum yield is obtained with the minimum spring rainfall (9.91 qx. and 100-150 mm.).

On the whole, it may be said that, with very rare exceptions, the rainfall in Argentina is always sufficient to ensure a good yield. Considering the territory as a whole, it will be found that during a period of 30 years there was only one year of real general drought, namely 1916. On the contrary, taking each province separately, it will be noticed that the winter drought becomes more frequent the further one advances into the interior of the country, for instance, in the provinces of Cordoba and the Pampa. The best rainfall, as regards quantity, is 100 mm. for the months of June and July and 100 mm. for those of September and October.

EFFECT OF THE TEMPERATURE. — The influence of the temperature on the yearly fluctuations in yield is much greater than that of the rainfall. In years when the yield is good, the spring temperature is below the normal whereas it is above when the yield is poor. The yield, is therefore, in

erse ratio to the temperature. The following are the coefficients of correlation for each succeeding two months after sowing :

June-July . . . . .	0.10
July-August . . . . .	0.32
August-September . . . . .	0.69
September-October . . . . .	0.75
October-November . . . . .	0.67

After August the negative action of high temperatures becomes evident and the coefficient of correlation during the whole period August-September is very high ( $-0.81$ ).

TABLE III. — *Difference between the Wheat Crop related from the retrogressive factor and the actual Crop (in kg. per ha.)*

Years	Estimated crop	Differing from the actual crop by	Years	Estimated crop	Differing from the actual crop by
1893 . . . . .	720 kg	— 17 kg	1905 . . . . .	699 kg	— 52 kg
1894 . . . . .	658	+ 84	1906 . . . . .	637	+ 109
1895 . . . . .	824	+ 172	1907 . . . . .	907	+ 2
1896 . . . . .	1032	— 184	1908 . . . . .	762	— 60
1897 . . . . .	845	— 10	1909 . . . . .	678	— 67
1898 . . . . .	678	— 119	1910 . . . . .	554	+ 81
1899 . . . . .	304	+ 40	1911 . . . . .	910	— 314
1900 . . . . .	658	— 99	1912 . . . . .	720	+ 17
1901 . . . . .	1053	— 160	1913 . . . . .	491	— 57
1902 . . . . .	803	+ 48	1914 . . . . .	866	— 131
1903 . . . . .	637	— 35	1915 . . . . .	554	+ 138
1904 . . . . .	470	— 4	1916 . . . . .	470	— 137
1905 . . . . .	803	— 39	1917 . . . . .	699	— 184
1906 . . . . .	658	+ 159	1918 . . . . .	762	— 48
1907 . . . . .	782	+ 55	1919 . . . . .	907	+ 84

In 1893 and 1898, in which years the Spring was *cold* and dry, the crop was as high as in 1919, when the Spring was *cold* and excessively rainy. Similarly, in the years when the Spring was *warm* and dry (e. g., in 1910-1916), the crop was as low as in those when the Spring was *warm* and (e. g., in 1896 and 1918).

In Argentine, therefore, the temperature is undoubtedly the most important meteorological factor from the point of view of wheat yield.

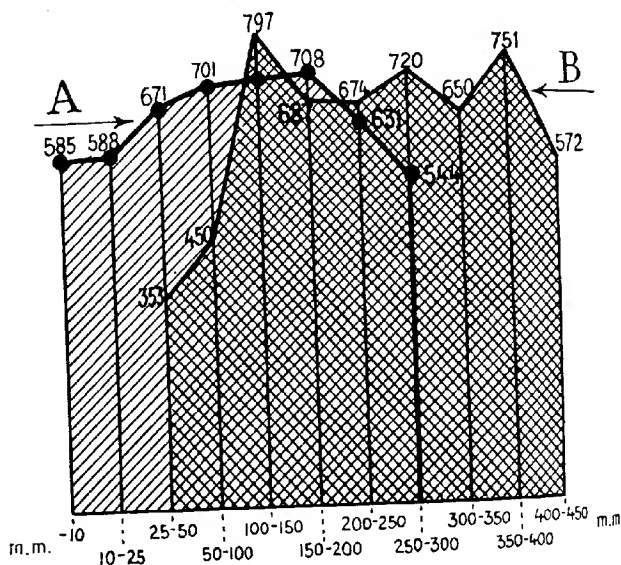
ESTIMATE OF CROP BASED ON THERMOMETRICAL OBSERVATIONS. — By using the coefficient of negative correlation between the yield and the temperature from August to November, it is possible, within certain limits, to estimate the future crop. For this purpose a constant factor must be found which, multiplied by the temperature or by the digressions from the normal, gives the yield.

This constant factor, generally called the "retrogressive factor", may be calculated by means of the formula  $b = \frac{\sum XY}{\sum X^2}$ , where  $b$  is the retrogressive factor,  $x$  the variable (in this case the temperature) and  $y$  the resulting variable (in this case the crop).

For the whole territory,  $b$  is equal to 208 for the months from August to November; if the temperature increases or decreases by one degree above or below the average for the above-mentioned period, there is a corresponding increase or decrease of 208 kg. of grain per ha.

Table III gives the data relating to the yield for the period 1890-1919, as estimated by the coefficient of retrogression, and the difference between the yield thus estimated and the actual yield.

*Correlation between grain yield and rain in Argentina.*



EXPLANATION.

$A$  = average yield in kg. per ha. in relation to winter rains (June-August);  $B$  = average yield in kg. per ha. in relation to spring rains (September-November); mm. = rainfall.

In most cases, the estimate is fairly correct. But there are exceptions among them and that of 1911 is very marked. In that year the yield, which had promised well, was damaged by the excessive rainfall of December the last part of the period of growth. In 1895 and 1914 the same happened.

again. Sometimes, though more rarely, late frosts attack the crops at an advanced stage; this happened in 1908, in the middle of October.

EFFECTS OF CLOUDINESS AND SUNSHINE ON THE WEIGHT OF THE HECTO-TRE. — The temperature and rain do not appear to exert any influence whatever in this respect. In the absence of data relating to hours of sunshine, the writer based his calculations on cloudiness, which is more or less inverse ratio to the hours of sunshine. An examination of the data shows that an increase of cloudiness is attended by a decrease in weight. G. A.

54 — Effect on the Yield of Wheat of Variations in the Degree of Humidity of the Soil during and after the critical Period. — AZZI G. in *Il Coltivatore*, Year LXVIII, No. 28, pp. 1-7. Casale Monferrato, Oct. 1922.

The experiments made in 1920-1921 at the Botanical Gardens of the Royal University of Rome on the Carlotta Strampelli, Apulia and delta varieties of wheat have fully confirmed the existence of a critical period in wheat in respect of the humidity of the soil; the period which corresponds with the period of the formation of the ear, would fall within the 30<sup>th</sup> day before and the 8<sup>th</sup> day after the formation of the ear (1).

In 1921-1922 experiments with the varieties Luigia Strampelli and Cervo were continued at the Botanical Gardens and at the Practical School of Agriculture at Rome. From April 24 until the harvest a series of weighings of whole plants (10 at each weighing) were made at fixed intervals and the length of each plant was measured. The results are given in Table I.

TABLE I. — Results of the experiments of 1921-1922.

Date of determination	Cervaro		Luigia Strampelli	
	Average weight per plant (with ear)	Length	Average weight per plant (with ear)	Length
	gm.	cm.	gm.	cm.
April . . . . .	5.3	59	5.5	58
May . . . . .	6.4	78	6.5	66
" . . . . .	8.6	82	11.8	87
" . . . . .	10.5	114	9.8	100
" . . . . .	9.6	115	9.1	104
June . . . . .	9.5	118	8.7	106
July . . . . .	8.9	118	7.7	107
" . . . . .	8.2	120	7.1	117
" . . . . .	7.8	120	6.5	118
" . . . . .	6.5	120	6.3	118

The Cervaro variety formed ears from the 15<sup>th</sup> to the 22<sup>nd</sup> May; the Luigia Strampelli from the 10<sup>th</sup> to the 16<sup>th</sup>.

These data confirm the fact of the existence of a critical period as regards moisture, in relation to earing. During the period (8-22 May)

(1) See R. March 1922, No. 299. (Ed.)

the length of the stalks and the weight of the plants increase rapidly. The plant as soon as it flowers, ceases to grow and after the flowers have set grain its weight begins to decrease rapidly ; when it has reached complete maturity, its weight is less by  $\frac{2}{5}$  than the maximum at the time of forming ears, in the two varieties quoted from 10.5 to 6.5 and from 11.8 to 6.3 respectively.

These decreases in weight indicate approximately the amount of moisture accumulated to keep pace with rapid transpiration and organic development.

Pot experiments (9 series of 5 pots for each of the two varieties) were made at the same time at the Botanical Gardens, by regulating artificially the waterings in variable quantities in the different series ; the ears were formed, on the average, between May 14 and 16, flowering took place from May 20 to 23 and the plants were cut from June 19-20. The experiments may be divided into 3 groups :—

1<sup>st</sup> GROUP (series 4-10 and 14-20). — Watering was done from 57 days before the formation of ears until 9-10 days before cutting.

TABLE II. — Results of the experiments of the 1<sup>st</sup> group.

Number of water- ings	Cervaro					Luigia Strampelli				
	Series	Number of plants	Number of stalks	Weight of grain from 5 pots gm.	Average weight of grain from each ear cgm.	Series	Number of plants	Number of stalks	Weight of grain from 5 pots gm.	Average weight of grain from each ear cgm.
2	4	18	21	9.10	48	14	18	28	11.5	41
3	5	18	21	12.75	60	15	18	30	16.17	55
4	6	20	20	10.87	54	16	18	27	13.6	69
5	7	21	23	10.00	42	17	20	46	23.5	51
6	8	16	25	21.00	84	18	18	40	25.6	64
7	9	17	33	16.50	50	19	18	42	23.7	59
8	10	19	36	22.50	62	20	17	50	32.6	65

The increase in the number of stalks and of the yield progressed *par passu* with the increased supply of water, but it was not possible to get the full maximum utilisation of the water.

The wheat plant was able to utilise the moisture in the soil up to 15 days after the formation of ears.

2<sup>nd</sup> GROUP (Series 3-13). — Waterings were started at the very beginning of the formation of ears and were continued as in the preceding group. When the waterings began the plants looked sickly and the ears were scarcely out of their sheaths. Watering caused a lively and rapid reaction, but the yield was scanty and only about half that of the preceding group.

3<sup>rd</sup> GROUP (series 2-12). — Abundant waterings 10 days after the beginning of the formation of ears ; these had no effect ; most of the plant

were already dead and those which survived yielded an insignificant amount of grain.

From the results of the experiments the following conclusions may be drawn:—

1) The critical period is comprised in the interval of 15 days just before the formation of ears; if, in that interval the moisture in the soil becomes less than the minimum amount compatible with the growth of the plants, the crop is reduced even if, during the remainder of the time, the conditions are quite favourable. If there is a large amount of moisture during the critical period, the yield will be high even if the conditions are less favourable during the remainder of the time.

2) When the soil remains dry during the critical period, waterings made when ear formation has begun cause a renewal of growth, but they are useless as regards the production of grain.

	Cervaro	Luigia Stampelli
Weight of grain from 5 pots . . . . .	5.9 gm.	6.5 gm.
Weight of grain per ear . . . . .	0.29	0.21

3) If the plants have enjoyed sufficient moisture during the critical period, they utilise waterings up to a very advanced stage of ripening. Operations made with the object of minimising the effects of drought could therefore be regulated in correspondence with the critical period, the duration of which is fairly short. A watering given too early, so that the soil remains dry during the 15 days which precede the formation of ears, and repeated at the time of flowering, has certainly less effect than a single watering given during the critical period. This fact is of great importance not only from a scientific point of view but also from the technical standpoint of the utilisation of the water.

A. de B.

55 - Report of the Study of the Soil of the First Egyptian Zone (Gharbija) in 1921. — HUGHES, F., in *Ministry of Agriculture, Egypt, Technical and Scientific Service, Bulletin* No. 21, pp. 1-11, fig. 1. Cairo, 1922.

SOIL PHYSICS

During the first half of 1921 a preliminary study was made in Egypt zone No. 1 (Gharbija) which lies between Fariskûr and Cafr-el-Wastani and has an area of 126 km<sup>2</sup>. In these investigations, about five hundred soil samples, taken at the depths of 1-2.3 m. and 1 km. apart, were used. A mechanical analysis was made of each sample, and the soluble salts and borides present were determined.

The soluble salts content was not very high, being on an average between 5.82 % (at the surface) and 6.45 % (at a depth of 3 metres), the amount of sodium chloride ranged from 3.84 % to 5.40 %. Sodium carbonate was rarely present. Owing to the impermeability of the surface, the chloride could be easily removed by means of proper drainage; this operation would be greatly facilitated by the general absence of the carbonate. The sub-soil is also impermeable, so there is little chance of

the salts being carried to the surface by water. At Kafr and Weka great success was attained in the reclaiming of saline land of this description.

The soil of this zone usually contains but little lime, otherwise its chemical composition is similar to that of the average Nile soils. The potassium content varies from 0.77 to 1.20 %; the phosphoric acid ranges from 0.21 to 0.32 % and the organic matter from 0.39 to 2.22 %.

A. de B.

1256 - **Report of a Study of the Soil of the Territory of the Right Bank of the Diahlah (Mesopotamia).** -- WEBSTER, J. F. (Officiating Deputy Director of Agriculture (Research) and WISWATARI, B. (Assistant Government Agricultural Chemist, Baghdad). *Department of Agriculture, Mesopotamia, Memoir No. 2*, pp. 1-29, figs. 6. Bombay 1921.

In 1920, the Agricultural Department of Mesopotamia undertook the study of all the occupied territory and investigated the region lying between the Tigris and the Diahlah, and situated between Deltaw and the confluence of the two rivers. The area of this district is 160 000 km<sup>2</sup>. Its climate is of the Mediterranean type, the annual rainfall being 7-8 cm. and the average relative humidity ranging from 60 to 80 % in winter, and falling to 38 % in June. The water of the Diahlah in spite of its high salts content, (0.07-0.1 %) is used for irrigation and the methods adopted are most primitive.

There are two crops in the year, one in winter and the other in summer. Barley (about 60 000 tons per annum) and wheat (some 2000 tons) are chiefly cultivated, but peas, date-palms, citrus-trees, cotton, maize, etc. are also grown. Fertilisers are only applied to gardens, and instead of making an intensive cultivation, the natives extend their crops as much as possible, in order to reduce their work to the minimum.

The soil is a calcareous alluvium. Many samples were taken at distances of 7 to 8 km. apart; 23 of these were selected for chemical analysis (determination of the soluble salts, nitrogen, carbon dioxide, potassium and calcium carbonate), while 13 were subjected to complete mechanical analysis. The soil is light and its physical conditions are good. The salt content is usually too low to have a distinctly deleterious effect. Sodium carbonate has ever been found in it.

The salts percentage is higher in the cultivated regions than elsewhere which makes it probable that the salts are chiefly derived from the drainage-water, and not from the ascent and evaporation of the water of the subsoil.

Almost half the soil is soluble in hydrochloric acid and is composed to a large extent of the carbonates of lime and magnesium.

The phosphoric acid content is sufficiently high to render the application of all phosphatic fertilisers useless, except in the case of intensive cultivation.

All the other elements of plant nutrition are present in great abundance which makes this region remarkably suitable for agriculture.

A. de B.

1257 - **The Aeration of Soil as an Ecological Factor.** — LARS-GUWNER, R., in *Meddelanden från Statens Skogsörsöksanstalt*, Vol. XIX, No. 2, pp. 125-359, bibliography of 24 works. Stockholm, 1922.

In this paper, the author discusses how far the increased deficiency of oxygen and excess of carbon dioxide caused by decreased gaseous exchange between the soil and the air are able to exercise an injurious effect and become important ecological factors.

Normally a very brisk gaseous exchange takes place between the biologically active layers of the soil and the atmosphere. The amount of carbon dioxide given off in one hour corresponds to the whole quantity contained by the soil to a depth of 20 cm. It may thus be assumed that the amount of carbon dioxide liberated is equal to that produced. On the other hand, biological activity is most intense near the surface, 68 % of the carbon dioxide being produced at a depth of less than 20 cm. Therefore a superficial layer contains all the carbon-dioxide that is produced in it in 100/68 of an hour (about  $1\frac{1}{2}$  hours). An interruption in the gaseous exchange lasting only half-an-hour would suffice to double the excess carbon dioxide. The author therefore concludes that normal gas exchange should be chiefly determined by factors with always, when taken together, an equal intensity. If particularly variable factors such as the wind etc., were the most important, there would be more rapid and greater variations in the composition of the soil air than have been found to exist. BUCKINGHAM maintained in 1904, that diffusion was of absolutely supreme importance as compared with the atmospheric factors, but his experiments were very limited.

The author has made a quantitative experiment on the effects of the various factors. He takes as normal aeration that found in one hour at a depth of 20 cm., and examined the influence exerted by temperature, atmospheric pressure, water, wind and diffusion.

The results of his experiments proved that diffusion was the chief agent of aeration in ordinary soils and the exclusive agent in wooded soils. Aeration and the relation between oxygen and carbon dioxide depend in the first instance upon the intensity of the distribution of bacterial activity in the soil and the number of pores full of air. As regards the pores, their average air content is not of decisive importance, but the amount of air present in the superficial layer.

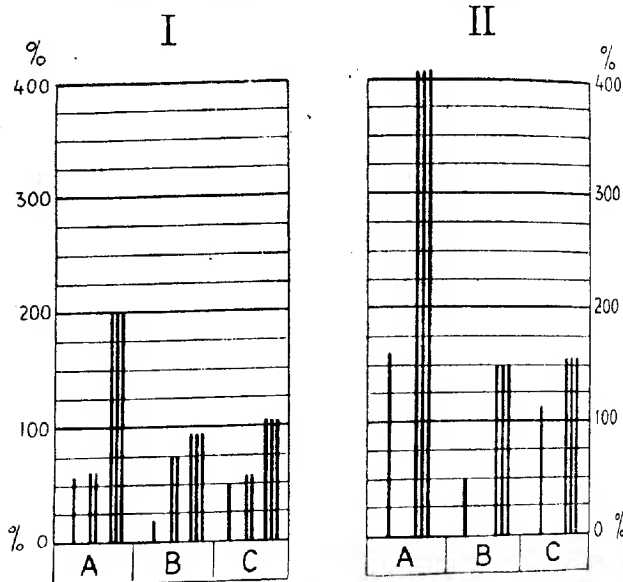
If  $p+$  represents excess carbon dioxide and  $p-$  deficiency of oxygen, it is seen that  $p+$  and  $p-$  are directly proportionate to bacterial activity. If this activity is equal, but differently distributed,  $p+$  and  $p-$  will be lower in a soil where bacterial action is most concentrated in the superficial layer. When the intensity and the distribution of bacterial activity are equal,  $p+$  and  $p-$  are inversely proportionate to the air content of the soil examined.

The size of the soil particles, provided their dimension is not below a minimum value, is of very secondary importance. A stratum of stiff clay gradually decreased the aeration which sometimes is reduced to 1/100 of the normal. If the pores are stopped up with water, the air present



sealed tubes, there was no appreciable change in the soluble salts content. Nitrification went on regularly. In general the nitrates decreased in sealed tubes.

Soluble substances in different ways.



EXPLANATION :

I = Sandy-clay soil; II = another sandy-clay soil.

1st line = superficial layer; 2nd line = subsuperficial layer; 3rd line = subsoil.

A = desiccation of damp soil in autoclave; B = desiccation of damp soil in air;

C = desiccation of air-dried soil in autoclave.

When the soil was kept at room temperature, and at the optimum degree of moisture for 9 weeks there was an almost negligible increase in the soluble substances in the case of all the soils, except the sandy clay, in which a slight decrease was observed. If these soils were kept at the same temperature, but saturated with water, the percentage of soluble matters rose considerably. In the first instance, nitrification was active, whereas in the second, complete denitrification took place.

Heating in the autoclave always had the effect of decreasing the nitrate content of the soil.

When two different concentrations of potassium nitrate were added to types of sand, the potassium salt could not be entirely recovered, even by means of 2 extractions with distilled water in the ratio 1:5. By one extraction

80 % was recovered from the more dilute solution, and 77-95 % from the more concentrated.

If potassium nitrate is heated for 8 hours at 150°C. after drying, a considerable amount is lost, viz. about 10 %.

A. de B.

9 - Experiment on the Leaching of Nitrate Salts of Calcium, Strontium and Potassium from the Soil by Rain, in Finland. — *Annales de l'Institut Agric. de Finlande*, 1921, in *Abhandlungen der Agriculturnaturwissenschaftlichen Gesellschaft in Finland*, 1921.

MAERKER calculated, by means of percolating experiments, that 100 kg. of Kainite, or other potassic salt, removed about 100 kg. of lime from the soil through exchange of bases, a fact which seriously compromised the utility of potash manures; but it appeared from experiments made in 1915, at the Station of Brême, that the quantity of lime removed was only from 8 to 24 kg., although the conditions were particularly favourable for the elimination of salts.

The problem was again taken up by H. von PHILITZEN, in Sweden 1912, and it appeared from numerous experiments that from lysimeters without manure more nitric nitrogen and lime were removed than from those manured with potassic salts. It appeared from later experiments that the manuring influenced the removal sometimes in one sense and sometimes in the other, but always to a slight degree.

The action of potash salts on nitric nitrogen is attributed to its action on the aerobic nitrifying bacteria, whose action was gradually decreased, thus causing a decrease in the nitrates removed. An increased activity of the anaerobic bacteria (due to want of oxygen) increases the quantity of salts capable of removal. The losses of potash salts by leaching were as great with salts containing 37 % of potassic oxide as with Kainite. An explanation may be found in the theory of electrolytic dissociation; in fact, as the cations cannot be removed without an equivalent quantity of anions, the losses occur only in reactions which imply the formation of the destruction of anions, which largely depend on the activity of the bacteria.

A. de B.

10 - Experiments on the free Acidity of Mineral Soils. — LIESEGANG, H., in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCIX, Nos. 4 and 5, pp. 191-220. Berlin, 1922.

The author describes a series of experiments undertaken for the purpose of elucidating various points connected with soil acidity which had hitherto been studied. Even in dilute solutions, all the acids used in the experiments (formic, lactic, sulphuric acid, etc.) set free acidity on mineral soils. It was found that the aluminium ion is practically the only one in the exchange, for the iron ion is hardly concerned in the process. Under natural conditions therefore free acidity cannot be said to originate from any one acid, but may be the result of any of the processes causing the formation of acids in the soil.

Very dilute solutions of aluminium and of iron salts give rise to a change in acidity, but even when a 0.02 N. solution of iron salts is introduced into the soil, it is not the iron ion, but the aluminium ion that

is the active principle in the exchange. This is due to the intense hydrolysis of the ferric salts and the consequent adsorption of the iron in the hydroxide condition, just as when ferric chloride is used, the action upon the soil is exerted by the hydrochloric acid and not by the iron ion.

Relatively small quantities of quite dilute solutions of carbon dioxide, very similar to those that may be found in the soil, also have the power of rapidly rendering a soil acid; this proves how much carbon dioxide has to do with soil acidity.

An intense degree of acidity can also be produced in aluminium silicate (the permutite of GANS), but only by means of carbon dioxide. All other substances produce precipitates that would decompose the permutite.

On the other hand, the action of acids and salts only produces a slight acidity in analcim; this perhaps may be explained by the fact that analcim differs greatly in structure from aluminium silicates. The author confirms the data obtained by GANS respecting molecular relations in soils, and taking as his basis GANS's views of the composition of aluminium silicates suggests a chemical formula for this compound.

After having demonstrated the impossibility of employing the colorimetric method for the determination of the amount of time necessary for the neutralisation of exchange acidity, the author states that in his opinion the best method for the purpose is that devised by PACKHARA which is based on the determination of the total acidity. A. de B.

1261 - **Clark's Hydrogen Electrode Apparatus and its Determinations of the Concentration of the Hydrogen Ions in the Soil.** — HEALY, D. J., and HARRAKER, P. E. in *Soil Science*, Vol. XIII, No. 5, pp. 323-328, bibliography of 4 works. Baltimore May 1922.

After giving an account of the various colorimetric and electric methods for the determination of hydrogen ion concentration, the authors describe a new apparatus constructed according to CLARK's specification which is easily handled and estimates the Ph value to 2 decimal places. Numerous trials have been made to test the accuracy of the machine, and the results obtained were entirely satisfactory. Higher values are given for air dried soil by this apparatus than by WHERRY's method. A. de B.

1262 - **Possible Correlation between the Fertility of Soils under Rice and their Titration Curves.** — ARRHENIUS, O., in *Soil Science*, Vol. XIV, No. 1, pp. 22-23, bibliography of 7 works. Baltimore, July 1922.

In Java as generally in the East the rice crops are of paramount importance, since rice constitutes the staple food of the natives. Owing to the great increase of the population, the amount at present grown fails to supply the demand and every effort is being made to improve the existing rice-fields and to plant new ones.

The rice crop in Java varies between 250 and 400 kg. per hectare with an average of 1000 kg. per hectare.

The author had determined the pH values of many different soils without finding any constant relation between these values and soil fertility.

tility. He found however that there was a constant correlation between the titration curves of soils and their buffer action, those being the most productive which possessed the highest intercepting property.

Plants secrete carbon dioxide and other substances that act as amphoteric electrolytes *i. e.* behave both as acids and as bases. The decaying parts of the plant behave in the same manner. If 14 rice plants are placed in nutrient solutions with a pH ranging from 3 to 9, it is found after 2 days that all the solutions have the same pH value, 6.2; for they have been neutralised to this specific point by the sap of the plant. Rice acidifies the soil, and if the soil possesses a slight degree of buffer action, the pH value undergoes considerable alteration. The rice plant does not grow well in very acid soils; hence the crops grown on soils rich in humus are nearly always unsatisfactory unless lime is introduced, when green manure and other substances with a high humus content can be applied with excellent results.

Soil acidity is also most injurious from another standpoint. Aluminium salts, which are toxic to the rice plant, are precipitated by neutral solutions but are soluble in acid solutions.

The application of lime may prove an effective remedy, but for very acid soil at least 2.5 tons per hectare would be required. In any case, to obtain a durable result it would be necessary to add some substance with a good buffer action, the best and cheapest being a good green manure.

A. de B.

1263 — **The Effect of the Magnesium and Calcium in Limestone upon the Chemical Composition of the Soil and on Plant Behaviour.** — MATHER, W. (Rhode Island Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 5, pp. 337-354, bibliography of 25 works. Baltimore, May 1922.

One of the most complex agricultural problems is the question of the action of calcium and magnesium; its speedy solution seems improbable, although much work has already been done with the object of throwing light upon the question. The author describes some experiments on a sandy clay soil which were begun in 1919 and continued for 11 years. Three applications were made of slaked lime (calcic and magnesian) and of ground calcic and magnesian limestone. The results obtained from the experiment fields thus treated were carefully tested and slight differences corresponding to the several forms of the fertiliser employed were found to exist.

Both the slaked lime and the limestone, whether calcic or magnesian, have equal power for neutralising soil acidity, if they are applied in equivalent amounts; this was proved by titration. They both render the aluminium in the soil relatively insoluble. When magnesian limestone is used, the proportion of lime and magnesium in the soil tends to remain the same as it was before the treatment.

The flora was not affected by the variable ratios between the oxides of calcium and magnesium, but showed itself very susceptible to the soil reaction.

Magnesian limestone is inclined to increase the nitrogen content of

[1262-1263]

the soil. Slaked lime, both calcic and magnesian, has so far caused no fall in the nitrogen percentage, but has slightly decreased the amount of organic matter present.

A. de B.

1264 - Distribution of the Phosphorus Ion in the upper Layers of the Soil in Relation to Vegetation and the Addition of various Salts: — L. BONCINI, G., and ROGAI, F. A., in *L' Agricoltura Italiana*, Year XLV, Nos. 4-6, pp. 109-124. Pisa, 1922.

The phosphorus ion rapidly becomes fixed in the soil, so that after the application of phosphatic fertilisers, it often happens that phosphorus is only found in the upper layers. In this connection, mention should be made of the experiments made at the Pusa Experiment Station, and by J. T. CRAWLEY and K. S. KAPIZOV. CRAWLEY found that if soil was irrigated immediately after being dressed with a phosphatic fertiliser more than half the phosphoric acid was fixed in the 2.5 first centimetres and  $\frac{9}{10}$  in the 7 first centimetres, little being found below the depth of 15 centimetres. When the irrigation was deferred for 15 hours, the phenomenon was still more accentuated, all the phosphoric acid being practically fixed in the first 7.2 centimetres.

Experiments have been undertaken to ascertain the effect exerted by vegetation or the addition of soluble salts upon this adsorption. It appears that their action generally renders the distribution of the phosphorus ion more uniform, and hence causes it to penetrate more deeply into the soil; they also increase the power of the soil for fixing soluble phosphates. S. SKALKIS, T. E. GREAVES and E. G. GARTER have carried out experiments on the same subject.

The authors have also taken up the study of this question. They used a wooden parallelepiped made of 10 superimposed frames each 3 cm. high that touched one another and could be removed and isolated. The apparatus was filled with 7.200 kg. of sifted soil. Two series were made each with 5 sets of frames. One series was carried out without plants, in the other two maize plants were used. The surface of each box was sprinkled over with 4 gm. of very finely powdered dicalcic phosphate. To 4 boxes of each series were also added equi-molecular quantities of different salts, viz., ammonium sulphate, sodium sulphate, ammonium nitrate and sodium nitrate, phosphate alone being added to the fifth box. As soon as they began to flower, the plants were cut to the level of the soil, the different layers of soil were separated and analysed.

The authors confirmed the statement that phosphate is chiefly fixed in the upper layers of the soil. They found that the presence of vegetation makes the distribution of phosphorus more uniform by reducing the number of phosphorus ions in the upper strata and increasing them in the lower. Thus in the three boxes to which phosphorus only was added, the box without plants was found on analysis to contain 5.42 per 1000 in the top layer and 2.06 per 1000 in the tenth, whereas the numbers of phosphorus ions in the boxes with maize were respectively 5.03 and 2.35 per 1000; the difference is not great, but it is appreciable.

The salts had the same effect as the vegetation, but vegetation in pre-

nce of the salts increased the attraction of the soil for phosphates. Thus with sodium sulphate in the box without plants, the figures were 4.80 and 19, as against 4.92 and 2.38 in the box containing plants. The behaviour of ammonium sulphate was somewhat different; 5.99 and 2.44 as against 5.57 and 2.48. As a rule, vegetation in the presence of soluble salts, instead of stimulating the descent of the phosphorus ions causes them to become fixed in greater numbers in the upper layers.

The authors also tried to determine the effect of the anions with unfixed cation and reciprocally, but the differences were neither large nor constant. Thus the ammonium ion, if added under the form of phosphate, promotes the descent of the phosphorus ion, whereas if added under the form of nitrate, it has the contrary effect; the behaviour of the sodium ion is just the reverse.

I. V.

65 - The Oxidation of the Sulphur in Alkaline Soils. — RUDOLFS, W. (New Jersey Agricultural Experiment Stations), in *Soil Science*, Vol. XIII, No. 3, pp. 215-229, fig. 1, bibliography of 7 works. Baltimore, March 1922.

In 1916 LIPMAN recommended the application of sulphuric acid or sulphur to soils containing sodium carbonate for the purpose of transforming this toxic salt into sodium sulphate and thus rendering fertile many regions that were wholly unproductive.

The results obtained by LIPMAN and SHARP from their experiments in this direction, though fairly satisfactory, did not warrant the adoption of this method.

From his own experiments on two samples of sandy-clay containing sodium carbonate, the author was able to draw the following conclusions:

By the inoculation of sulphur, and consequent formation of sulphates, the soil seems to acquire new physical properties among which are more complete flocculation, a change in its water-containing capacity and in its apparent specific gravity.

In soils containing little sodium carbonate, small quantities of sulphur have no effect upon the pH value though a large amount brings about decided changes which were almost the same in an incubator at 28° C. and with the optimum degree of moisture as in a regularly watered greenhouse.

Soils that had been previously washed were more quickly neutralised by the addition of sulphur than unleached soils, as was proved by acid tests and the determination of the pH. After 18 weeks the sulphur was practically oxidised in all the cultures. When the oxidation of the sulphur increased, the carbonates were transformed into bicarbonates.

The author observed a strict correlation between the formation of sulphate, the flocculation and the apparent specific gravity of the soils whether leached or unleached. The formation of sulphates seemed to cause the sodium carbonate and the sample of sandy-clay to aggregate which produced change in the water-holding capacity of the clay.

The microflora, as represented by the number of colonies that made their appearance on the agar plates, varied in proportion to the pH. The

cultures in the unwashed soils inoculated with a sufficient amount of sulphur to neutralise their alkalinity produced, after 12 weeks' incubation, 5 times as many colonies as those in the untreated soils, and the cultures of the washed soils produced 3 to 5 times more colonies than the corresponding untreated cultures.

In cultures of washed soils, which after the addition of sulphur, had nearly the neutral value of pH, there appeared relatively few colonies of moulds and actinomycetes, whereas the cultures on the agar plates inoculated with unwashed soil were almost entirely composed of colonies of moulds and actinomycetes.

Barley-seed germinated and grew with great rapidity in alkaline soils inoculated with sulphur, but the seedlings were always killed by the saline crusts on the surface of the soil which were dissolved when the pots were watered, but the water only penetrated very slowly into the soil owing to its bad physical condition.

A. de B.

1266 - **Bacteria connected with the Oxidation of Sulphur in the Soil: Media used for the Isolation of Sulphur Bacteria from the Soil.** — WAKSMAN, S. A., in *Soil Science*, Vol. XIII, No. 5, pp. 329-335, bibliography of 17 publications, Baltimore, May 1922.

It has been known for a long time that sulphur can be oxidised by various groups of bacteria which draw their energy from it instead of from carbon compounds. These bacteria may be divided into three groups according to their physiological characteristics:

I) *Sulphide Bacteria*, which oxidise especially sulphuretted hydrogen and sulphides, and which may be subdivided into 3 species:

- a) colourless bacteria, producing threads, which accumulate the sulphur in their cells,
- b) colourless bacteria, not producing threads,
- c) purple bacteria.

II) *Thiosulphate Bacteria* or of thionic acid, which especially oxidise thiosulphates and, partially, sulphides and pure sulphur.

III) *Sulphur Bacteria*, which oxidise free sulphur and, differing from the two former groups, do not accumulate sulphur in their cells but produce a large amount of sulphuric acid.

The bacteria of the 1<sup>st</sup> group (a, b, c.) belong for the most part to the *Thiobacterales*; those of the II<sup>nd</sup> and III<sup>rd</sup> groups belong to the genus *Thiobacillus*.

Another classification might be based on the optimum reaction of the activity of the organisms; the first two groups have the optimum on the alkaline side, the third on the acid side.

The writer next describes 9 media, which he used for isolating the organisms which oxidise sulphur, of which 3 were discovered by the writer himself, and he gives their chemical composition.

A. de B.

1267 - **Biochemical Methods for Determining the Fertility of Soils.** — STOKLASA, J., in *Chemiker-Zeitung*, Vol. XLVI, No. 91, pp. 681-683. Cöthen, Aug. 1. 1922.

In 1 ha. of soil, from the surface to a depth of 40 cm., there are from 200 to 400 kg. of bacteria, and among these the total of live bacteria is as much as about 10 quintals. This mass may exert a decided influence on the fertility of the soil. The following groups of organisms live in field soil: 1) bacteria — 2) mycetes — 3) algae — 4) protozoa — 5) rotifera — 6) oligochetes — 7) nematodes — 8) euchitriodes — 9) tardigrades — 10) arachnidae — 11) insects — 12) molluscs — 13) mammals. H. FRANCE proposed, in 1912, to give the name of "edaphon" to the whole of these soil organisms which live together like the plancton in the soil.

To sustain life, all these organisms need: oxygen, hydrogen, carbon, nitrogen, phosphorus, sulphur, chlorine, silicon and manganese. In the case of the heterotrophic organisms carbon can only be assimilated in an organic form, hence the great importance of organic matter to the life of the "edaphon". Oxygen and water are equally essential; the various organisms in the soil really strive for water; hence it is fundamentally necessary to determine the water and air capacity of a soil in order to make a biochemical study of it.

The ratio of oxygen to carbon in a soil indicates the ratio of aerobic organisms to anaerobic; their condition is also influenced by partial pressure of oxygen, the absence of which is detrimental to the process of assimilation and causes an intermolecular respiration of the roots.

Soil reaction is likewise very important, not only from the physiological, but also from the phytopathological point of view. The concentration of hydrogen-ions has a great influence on the absorption of nutritive substances; soils with an alkaline or neutral reaction absorb much more vigorously than acid soils.

From the biological point of view, the germ content is of the utmost importance: and not only the colonies of bacteria, but also various species of fungi, and algae. The greater number of micro-organisms are concentrated in the upper layer of 10-25 cm.; beyond a depth of 40 cm., their number rapidly decreases; the true germ content is, according to the vegetation, from 28-87 millions (in a field of oats) to 80-120 millions (in a clover field) per quintal of dry soil; in forest land, 15-26 millions which decreases to 5-9 millions in acid zones; and in pasture land it is 6-10 millions.

The microflora of the soil, which has so great an influence on fertility, needs elements in a form which renders them capable of being easily assimilated, and especially carbon, which forms 44-45 % of their substance.

The bacteria of the soil are divided into autotrophic, which may form carbon and proteins hydrates from carbonic acid and mineral salts, and heterotrophic, which assimilate carbon and nitrogen only in an organic form. In soils whose air content is less than 2 %, the anaerobic processes of the autotrophs are in the ascendant. The activity of the aerobic bacteria and the facility with which the organic matters of the soil which



nourishes them are decomposed are shown by the quantity of carbonic acid which forms in the soil, after the elimination of certain factors.

The long researches by ERNST and STOKLASA have shown that the respiration of autotrophic and heterotrophic bacteria depends on the water and air content of the soil, on its composition, the facility with which the organic matters are decomposed, reaction, manuring, tillage and culture of this soil. The quantity of carbonic anhydride produced is from 8 mgm. (sterile soil) to 68 mgm. (soil under beets) per kg. per day. Below a depth of 80 cm. only traces are found.

It may be estimated that a production of 30 mgm. of carbonic anhydride per kg. of soil at a depth of 36 cm. corresponds per ha. to 150 kg per day and 300 quintals or 30 millions litres for 200 days of the year. The liberation of this gas largely helps to render the soil porous and also raises the temperature 1 or 2 degrees. The carbonic acid formed transforms the insoluble di-, tri- and tetraphosphates into soluble phosphoric acid and also renders the calcium, potash and magnesium salts soluble. Another very important consequence of bacterial respiration is the transformation of the cations of the soil into bicarbonates, which possess an essential nutritive and regulating function; in addition to metals, they furnish plants with a certain quantity of carbonic anhydride. Plants also have special organs on the under surface of the leaves for receiving the carbonic anhydride which emanates from the soil. If a concentration of 0.1-0.25 % of carbonic anhydride in the air increases the yield of certain plants by 200 %, the same result may also be obtained by supplying the roots with anhydride in the form of bicarbonate.

It is therefore of great importance to be able to increase the bacterial production of carbonic anhydride; the mode of procedure can only be indicated by a biochemical examination of the soil. The radioactivity of soils is also very important; it has a powerful influence on the activity of microflora and macroflora; the most radioactive soils are the granite soils ( $2.58 \times 10^{-12}$  gm. of radium per kg.); and generally, sedimentary soils are less radioactive than volcanic soils.

Radioactivity stimulates to an extraordinary degree the processes of assimilation and dissimilation by bacteria. A radioactivity in the air of 30 M E (or 0.000011 mgm. of radium) suffices to increase by 60 % 130 % bacterial respiration and the inherent processes such as formation of carbonic anhydride, heating, etc. Nitrifying bacteria are also rendered highly active by it. The close connection between radioactivity and soil fertility therefore becomes more and more evident. A. de B.

1268 - **The Effect of the Application of various Salts upon the Nitrogen-Fixing Properties of Soil.** — GREAVES, J. T., CARTER, T. G., and LUND, J., in *Soil Science* Vol. XIII, No. 6, pp. 481-499, bibliography of 51 works, Baltimore, June 1922.

The authors after having studied the ammonification and nitrification of a calcareous clay, now describe a series of experiments on the nitrogen-fixing capacity of the same soil, the methods adopted being those previously used. A large number of 100 gm. soil samples were analysed and placed

in sterilised test-tubes the same amount of lactose, and different quantities of the various salts used in the experiment being added in each case. The humidity was brought up to 18 %, and the samples incubated at 28°-30° C. for 3 weeks. The amount of nitrogen was then estimated by taking the average of at least 4 determinations.

The authors employed in their experiments: the chlorides, nitrates, sulphates and carbonates of sodium, potassium, calcium, magnesium, manganese and iron. The results obtained led them to adopt the following conclusions:

The toxicity of the salts used depends upon the nitrogen fixation of the given salt, and not on the negative electro ion as in the case of the ammonifying bacteria. In this respect nitrogen-fixing bacteria resemble nitrifying bacteria. In the soil chosen for the experiment, the salts proved less toxic to the nitrogen-fixing bacteria than to the nitrifying and ammonifying bacteria.

The amount of a salt that can be introduced into a soil without hindering nitrogen-fixation varies according to the salts. The proportions below which some of the salts proved innocuous were as follows:— Sodium salts, 1 part in 400 million parts of soil; calcium nitrate, sulphate and carbonate, 1 part in 400 million parts of soil; magnesium chloride and sulphate 243; manganese nitrate 550; ferric chloride 272.

The other salts became toxic in certain proportions in the following order:

- |                        |                        |
|------------------------|------------------------|
| 1) Magnesium carbonate | 8) Calcium chloride    |
| 2) Magnesium nitrate   | 9) Manganese chloride  |
| 3) Potassium carbonate | 10) Potassium chloride |
| 4) Iron carbonate      | 11) Potassium sulphate |
| 5) Manganese carbonate | 12) Potassium nitrate  |
| 6) Iron nitrate        | 13) Manganese sulphate |
| 7) Iron sulphate       |                        |

None of the potassium chloride and carbonate concentration used in the experiment stimulated nitrogen fixation. The other salts, especially calcium, nitrate, sodium carbonate and potassium sulphate, increased it in varying degrees.

When the soil is not acid, the alkaline constituents hinder ammonification and nitrification much sooner than they retard nitrogen fixation.

A. de B.

1269 - **The Agricultural Value of Sea-sand.** — BORTASE, V. and GREGG, A., in *Journal of the Ministry of Agriculture*, Vol. XXXI, No. 7, pp. 591-599. London, October 1922.

It has long been customary in Cornwall to dress the land with sea-sand which contains a large proportion of calcium carbonate derived from the shells of marine molluscs.

In this district, the wind carries inland the sand from the beach and piles it up into dunes often fifteen metres in height and covering vast areas. Large quantities of this sand have been used for agricultural purposes for

many centuries. At one time it was considered that the sand had no value, but it has been used in increasing quantities during the last 20 years, its low price causing it to be preferred to lime. The seasand is applied alone, or more often mixed with straw, dung, or some other natural fertiliser, usually at the rate of 10 to 15 tons per hectare, although sometimes twice the amount is used.

As the calcium carbonate content of the sand ranges from 2 to 84 %, its calcium oxide percentage varies from 4.5 to 47 %. The sand contains no other substance of agricultural value, sodium chloride being present only in negligible quantities (0.002-0.03 % in dry sand, and 0.1-0.78 % in damp sand). As the sand can be obtained for almost nothing, the cost of the lime it contains depends entirely on transport. Slaked lime is much more available than ground limestone or sand; while ground limestone being a little finer than this sand is slightly more readily assimilated by plants. The relative prices of the different substances vary according to the locality. At Truro, one of the largest industrial centres, one ton of calcium oxide costs 45 shillings in the form of slaked lime, 71 shillings as ground limestone, and 20 shillings as sand.

Numerous experiments have been made to determine the manurial value of seasand. In 1920, three meadows were fertilised respectively with the three forms of lime associated with phosphates, potassium and ammonium sulphate. All three meadows did well, but the one manured with sand was superior to the others.

In other experiments conducted at Rochelle, the plots to which lime had been applied were distinguished by the clover growth and the small number of weeds present, whereas the other plots were infested with weeds. The plot that had received sand (4.06 tons at £1 12s. was equal or superior to the others to which respectively 2.03 tons of ground limestone at £3 10s, and  $\frac{1}{2}$  ton slaked lime at £1 13s. had been applied. The prices of the sand and of the slaked lime were thus about equal, but 8 times more of the sand were required.

Amongst farmers there is a considerable consensus of opinion in favour of seasand. As a rule it produces a considerable increase in the clover yield, and cattle show a decided preference for pastures that have been so treated. In districts near the sea-coast, the application of sand is less profitable, because the soil has already received much of the lime it needs without any cost of transport. Many farmers have observed that whereas all forms of lime are injurious to oats, seasand has proved the most harmful. On the other hand it does much less harm to beets than lime which is generally applied to this crop. As the soils in Cornwall are already light, the addition of seasand has little mechanical effect and its agricultural importance depends upon the general deficiency of lime in these acid soils and the fact that slaked lime has to come from a distance.

The author recommends the study of the many seaside districts of England that are rich in sand with a view to the possible working of this source of lime.

A. de B.

270 - **The Effect of the continuous Application of Chemical Fertilisers upon Soil Reaction.** — BURGESS, P. S., in *Agricultural Experiment Station of the Rhode Island State, College Bulletin* 139, pp. 3-35, bibliography of 22 works. Kingston, Rhode Island April 1922.

The author describes a series of experiments undertaken with the object of determining the effect of different fertilisers upon the reaction of the soil. These experiments were conducted at the Rhode Island Experiment Station where there are many plots under the same conditions and occupying an extensive area of sandy-clay which were eminently suitable for the purpose. Samples of soil were analysed every 4 or 5 weeks from May to September 1921; they were taken near the surface (10 cm.), 12 to 26 borings being made for plot. The hydrogen ion concentration was determined in each case by HILDEBRAND's electrometric method, and the lime requirement by JONES' calcium acetate method.

The following conclusions can be deduced from the results obtained: Basic slags, superphosphates, bone-manure and mineral phosphate waste all help to decrease soil acidity, as was shown by the comparison of the treated and untreated plots respectively. The three first fertilisers proved the most active in this direction. There is thus no foundation for the common opinion that the continued use of superphosphates renders soils acid.

Finely-ground fish-guano and sodium nitrate perceptibly diminish soil acidity, whereas dried blood, decomposed fish, ground hoofs and flail from the abattoirs and poulterers increase the acidity slowly but readily. Ammonium sulphate has always been found to increase soil acidity more than any other nitrogenous fertiliser.

All the potassium salts slightly diminished the acidity of the soil, kainit being the most active; next come the chloride and sulphate of potassium (though there is a little difference in their influence. The carbonates of sodium and potassium have much more effect than the chlorides of these elements in reducing acidity and, calculating the oxide equivalent, are as effective as lime fertilisers.

Soil acidity is slightly lowered by the application of a green manure composed of non-leguminous plants, but is raised by the ploughing in of a leguminous crop; this is perhaps to be attributed to the fixation of the nitrogen contained in the leguminosae.

Other factors besides fertilisers are naturally concerned in influencing the soil reaction, of these the chief are the type of soil and the nature of the crop. They must all be taken into account before any general laws can be formulated.

A. de B.

271 - **Manuring Fish Ponds: Exchange of Bases in the Soil.** — MEHRING H., in *Fischerei-Zeitung*, Vol. XXV, No. 27, pp. 297-299. Neudamm, July 2, 1922.

In a soil, exchange of bases always takes place when there is an active substance in excess. The following is a characteristic example:— if lime spread in excess on a field rich in potassic minerals, e.g. mica, potash is displaced and exerts its fertilising action; in a soil of this kind manuring on a lime basis is equivalent to potassic manuring. But if as a result

of an immediate success, too much lime is added, it displaces the potassium in the form of hydrate or bicarbonate in larger quantity than the plants can absorb, and the excess of potash is carried away by rain. If this process is repeated the soil becomes poor in potash to such a degree as to become sterile, as has happened in certain places. Gypsum may have the same effect.

These considerations are applicable to the problem of manuring fish ponds. The formation of a reed bed is a certain indication of impoverishment of the soil; if this impoverishment is very marked, horse-tail shows itself. Using lime as a remedy against the reeds only increases the evil as still more potash is removed from the soil. Manuring with 50 kg. of basic slag, 75 kg. of kainite and 150 kg. of marl causes the horse-tail to disappear. The reeds when once rooted out are prevented from returning by a strongly potassic manuring. It is always best to give a complete manuring on the basis of phosphoric acid, lime and potash: but an excess of lime, already given in the basic slag, should be avoided and if necessary corrected with potash.

A. de B.

1272 - **Waste Water from Wool-Washing, as a Source of Fertiliser.** — VEITCH, F. P. (Bureau of Chemistry, U. S. Department of Agriculture, Washington), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, p. 434. Washington, May 1922.

The United States annually consume over 275 000 quintals of unwashed wool. About a half is composed of various impurities, salts, fatty substances and other albuminous matters that must be carefully removed. With the exception of the fats, these foreign substances are all thrown into the rivers where they contaminate the water. Wool in the yolk contains: 6 to 42 % fatty matters (average 14 %); 5 to 33 % (average 14 % water-soluble substances; 0.3 to 0.11 % (average 0.6 %) nitrogen (in addition to the amount entering into the composition of the wool); 1 to 7 % (average 4 %) potassium. At the present time in the United States an amount of potassium corresponding to 100 000 tons of kainit, and worth 840 000 dollars are annually thrown away.

Numerous attempts have been made to recover the potassium salt and other matters, but apparently without success, except in the case of the small percentage of fat present. This problem should however be further studied and all the more since many States insist upon the wool factories purifying their waste water before turning it into the rivers. This entails heavy expense for which no compensation is obtained by the utilisation of the products recovered.

The Bureau of Chemistry of the Department of Agriculture has just begun experiments on a large scale in order to turn these waste substances to good account.

The concentrated washing water contains 42 % water, 14 % potassium oxide, 1.25 % nitrogen and 14 % fatty matters. The dried fatty residue contains 24.5 % potassium oxide, 25.5 % nitrogen and 0.6 % fat.

The fertilisers are made by mixing these residues with the waste product of other industries. They contain 6.5 % soluble potassium oxide, 6.1 %

total nitrogen. 3.4 % water-soluble nitrogen and 6.8 % fatty substances. These fertilisers are in excellent mechanical and hygroscopic condition and are easily handled.

A. de B.

1273 - **Influence of Humic Acids on the Assimilation of Phosphoric Acid.** — MACK, K., in *Chemiker Zeitung*, Year XLVI, No. 9, pp. 73-75. Cöthen, January 1922.

Phosphoric acid is found in the soil in the form of primary, secondary and tertiary phosphates of alkaline, alkaline-earth metals, aluminium, iron and manganese; and it is perhaps also present as a tetraphosphate of alkaline-earth metals, aluminium, iron and manganese. The water of the soil which contains phosphated ions becomes separated from the insoluble phosphates through the action of calcium-, magnesium-, aluminium- and iron-hydrates, magnesium- and iron-carbonates and certain silicates. Through the activity of soil bacteria, which, during respiration, produce carbonic anhydride and, in disintegrating organic substances, produce acetic, lactic, butyric and valeric acids, the insoluble phosphates become partly soluble again. Further, in soils rich in organic substances a large quantity of humic acids are formed which render the phosphates soluble. Phosphoric acid is found in the soil not only in a mineral state but also in the form of organic compounds such as phosphatids (lecithin), phytine and nucleoproteids, as is shown by the works of STOKLASA and other writers. These organic combinations are due to the remains of plants incorporated in the soil (stubble, roots, etc.). STOKLASA observed that the phosphoric acid combinations found in the soil are much more energetically assimilated, under the action of bacteria, than pure insoluble phosphates. He was also led to conclude that the soil contains other forms of phosphates than those recognised hitherto, notably easily-assimilated humophosphates (1).

The writer has made a series of experiments with the object of determining the effect of humic acids on the various phosphates. The acid used was extracted from peat, which was treated with sulphuric acid to separate the alkaline humates: 10 gm. of pulverised "humic" acid were added to a quantity of phosphate corresponding to  $\frac{1}{100}$  molecular-grain of phosphoric acid and the whole was left for 48 hours in 1 litre of water, and was frequently stirred. The results proved that humic acids render soluble the following quantities of phosphate, expressed in % of phosphoric anhydride: 29.45 % of dicalcic phosphate, 28.46 % of tricalcic phosphate, 2.54 % of tertiary aluminium phosphate and 7.46 % of tertiary iron phosphate. Humic acids therefore act on insoluble phosphates as dissolvents. A remarkable fact is that they act on dicalcic phosphate in the same way as on tricalcic phosphate.

Humic acids act differently when alkalis are present. Thus, humate

(1) On the subject of "humophosphates" and humous matter and manures in general, see the interesting works of Prof. J. DUMONT (of Grignon), published under the titles of: *Les matières humiques du sol* and *Les engrais humiques*. Paris, Charles Amat (publisher), 1909. (Reviewer's note)

of ammonia renders soluble less tricalcic phosphate than in the former case (23.08 %  $P_2O_5$  as against 28.46 %), but, on the other hand, much more tertiary aluminium phosphate (23.77 % as against 12.54 %) and tertiary iron phosphate (20.37 % as against 7.46 %).

With metallic oxides, humic acids and humates are capable of forming complex combinations, containing the metal in the anion. Thus, ammonium humate may combine with aluminium and iron phosphates to form compounds containing, besides iron and aluminium, phosphoric acid, otherwise known as salts of a "humosphosphoferric" acid and a "humosphosphoaluminic" acid. Pure humosphosphoferric acid has been isolated; it is a bituminous, blackish-brown substance, soluble in alcohol up to 2.65 %.

To determine the action of humic substances in the presence of insoluble phosphates, experiments were made on different kinds of soil which were well washed until completely free from phosphoric acid and of which an extract was afterwards made with 0.5 % ammoniac.

From 100 gm. of forest soil containing 0.095 % of phosphoric anhydride, an ammoniacal extract was obtained of which the ash contained:

Phosphoric anhydride . .	0.0488 gm.,	corresponding to 51.37 % of the total anhydride.
Sesquioxide of iron . . .	0.0439	"
Alumina . . . . .	0.0192	"
Lime . . . . .	0.0113	"

In a soil rich in bone and lime phosphates only 3.5 % of phosphoric anhydride were found to be present, which agrees with the fact that marshy soils rich in lime are not very fertile. From a garden rich in mineral and organic fertiliser, 25.27 % of anhydride were obtained.

The excess of bases over phosphoric acid shows that the latter is present especially as a basic phosphate. In soils with an alkaline reaction, aluminium and iron phosphates are combined with the humic basis, which explains their greater fertility.

Humosphosphoferric and humosphosphoaluminium acids therefore serve to supply plants with phosphoric acid and perhaps with iron and aluminium in a form which can be easily assimilated. This was fully confirmed in a series of experiments in which beets were cultivated in various nutritive solutions, of which some were exclusively mineral while others contained humate of ammonia. After 18 days, there was still considerable quantity of phosphoric acid in the first solutions, while the second contained no further traces. Other experiments are being made, but already in practice preparations of peat and ashes used as fertilisers, and the addition of iron hydrate to the ordinary fertilisers have given good results.

The writer concludes by saying that greater importance should be attached to raw phosphates containing oxide of iron, such as those of Bavaria and the Hartz mountains; he is not in favour of the use of superphosphates, which eventually render the soil too acid. The use of manure, on the other hand, should be widely developed. In regions where, from climatic or economic reasons, it is impossible to rear livestock,

peat might be employed with advantage, for it not only renders phosphoric acid assimilable, but also furnishes nitrogen and it is a good medium for bacteria, which thus increase the carbonic acid of the soil. A. de B.

1274 - **The Agricultural Value of the insoluble mineral Phosphates of Aluminium, Iron and Calcium.** — MARAIS, J. S. (University of Illinois), in *Soil Science*, Vol. XIII, No. 5, pp. 355-409, 5 pl. apart from the text, bibliography of 85 works. Baltimore, May 1922.

The great demand for phosphates and their high price recently suggested the idea of using for agricultural purposes the deposits of iron and aluminium phosphates. In spite of the many satisfactory results already obtained, the opinion that the value of these phosphates is practically negligible is still very widely held, even by experts. The author reviews the extensive bibliography of the subject and gives an account of a series of experiments made with a view of comparing the phosphates of iron and aluminium with those of calcium. The aluminium phosphates used were azulite, wavellite and Sadanha, a South African phosphate; the iron phosphates, dufrenite and vivianite; and the calcium phosphates, the crude phosphates of Florida and South Africa. All the aluminium phosphates are basic; lazulite is completely insoluble in acids, and even after half an hour's treatment with hot aqua regis only yields traces of phosphorus hydride. Wavellite and Sadanha phosphate dissolve readily in acids.

Five experiments were carried out: a) to compare the effects of the different phosphates; b) to try the effect of phosphates in sand cultures; c) to determine the influence exerted by the nitrification of urea upon the availability of the different phosphates in the soil and in sand cultures; d) to determine the availability of chemically pure phosphates of calcium, iron and aluminium and the effect of calcination; e) to determine the other factors influencing the availability of insoluble phosphates.

The author's conclusions are as follows: the mineral phosphates of aluminium and iron are good sources of phosphoric anhydride for plants; under certain conditions, but not always, they are also superior to calcium phosphate.

The nitrification of urea and the resulting production of acids have a very beneficial effect, as they materially assist plants in assimilating the phosphates of aluminium, iron and calcium which serve them for food.

Chemically pure phosphates of aluminium and iron can be assimilated by plants with the same facility as calcium phosphate. The mineral phosphates are not equally available, because most of them are hydrated basic phosphates. The calcination of the minerals dehydrates the bases and destroys their crystalline structure which removes all objections to the use of mineral phosphates. The pure or mineral phosphates of aluminium, whether calcined or not, exert their maximum effect on calcareous soils.

The effect of iron phosphates is not altered by the addition of lime, at any rate under the conditions obtaining during the experiment. On the other hand, the effect of tricalcic sulphate is much decreased by the presence of lime.



In an alkaline solution aluminium phosphate is dissolved in the soil and readily assimilated by plants.

The contact of the roots with the mineral phosphates is a very important factor for the assimilation of phosphorus anhydride. A. de B.

1275—**The Effect of Mineral Phosphate upon Phosphoric Acid Absorption and the Productivity of Maize and Sorghum.** — FRAPS, G. S., in *Texas Agricultural Experiment Station, Division of Chemistry, Bulletin No. 289*, pp. 1-17. College Station, Brazos County, Texas, February 1922.

This paper gives the results of experiments carried out at the Texas Experiment Station with a view to determining the effect of mineral phosphate upon phosphoric acid absorption and the productivity of maize and sorghum.

To a series of 5 kg. samples of soil poor in available phosphoric acid were added 1 gm. ammonium nitrate and 1 gm. of potassium sulphate. In some cases, increasing amounts of the phosphates used in the experiment were introduced. In this soil maize and sorghum were grown and subsequently their ash was analysed. The conclusions were based more upon the amounts of phosphoric acid abstracted from the soil by the crops than upon the weight of the crop.

The effect of mineral phosphate was about 75 % of that exerted by dicalcic phosphate. The pots given no phosphate produced about 40 % of the yield obtained with a complete fertiliser.

Reckoning the amount of phosphoric acid absorbed by a maize crop by parts per million of soil, 5.53 parts are obtained by the addition of phosphate and 9.43 by the application of mineral phosphate at the rate of about  $2\frac{1}{4}$  tons per hectare (corresponding to 330 parts per million of phosphoric acid) or an increase of 3.4 parts per million of phosphoric acid, equivalent to 847 kg. of maize per hectare.

By increasing the amount of phosphoric acid (from mineral phosphate) from 300 to 600 parts per million the average quantity of phosphoric acid absorbed by a crop is only increased by 0.63 part per million.

When 0 — 300 — 600 — 1200 parts per million of phosphoric acid were respectively added to the soil (which would correspond to 0 —  $2\frac{1}{4}$  —  $4\frac{1}{2}$  — 9 tons of mineral phosphate per hectare), the amounts of phosphoric acid absorbed by the crops were respectively 5.86 — 10.14 — 10.69 — 11.84 parts per million and 0 — 1.43 — 0.80 — 0.50 parts per hundred parts of phosphoric acid added.

These data show that :

a) The addition of phosphoric acid in quantities exceeding 24 tons of mineral phosphate per hectare has little effect upon the amount of phosphoric acid absorbed by the crop and hence on the crop itself, in accordance with the law of decreasing yields ; and the crops diminish very rapidly.

b) The addition of 2 tons of mineral phosphate per hectare increases the maize yield about 847 kg. per hectare, and since only 1.4 % of phosphoric acid is absorbed by each crop, this rise should last for some years.

Mineral phosphate is thus a fertiliser with very weak but prolonged action; the improvement it produces annually is relatively slight, but its good effects are repeated for several years in succession.

The experimental comparison of different phosphates proved that the soft Florida phosphate is a little more effective than hard Tennessee phosphate. The percentage of phosphoric acid absorbed by the crop was 1.98 in the case of the Florida phosphate and 1.52 in that of the Tennessee; dicalcic phosphate however proved much more available than either.

Under the conditions of soil analysis, the phosphoric acid of mineral phosphate is almost wholly soluble in nitric acid N/5, but the phosphoric acid added to a soil by mineral phosphate is not as available as that already present in the ground.

A. de B.

1276 — On the Alkalinity of Basic Slag. — DEMOLON, A., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 24, pp. 680-683. Paris, July 1922.

Basic slag brings to the soil a considerable quantity of lime.

It gives remarkable results in all soils which show a tendency to acidity, and its action is shown especially by a modification of the flora in favour of legumes. The writer has studied a certain number of slags from the point of view of the value of their lime content as assisting in soil reaction.

*Percentage of lime in basic slag rendered soluble  
by the different liquids employed.*

Sample No.	Distilled water	Sweetened water at 5 %		2 % Phenol	Neutral Solution of humate of ammonia	5 % Chloride of ammonia cold	Carbon dioxide in saturated solution: 100 cc.	Total lime (soluble in mineral acids)	Oxide of magnesium
	Slag: 1 gm. Water: 100 cc. — stirred 1 hour	Raw	After de-carbonisation	Slag 1 gm. Reaction: 100 cc. — 1 hour	Slag: 1 gm. Reaction: 100 cc. containing 0.3 gm. of humates	Slag: 1 gm. Reaction: 100 cc. — 1 hour	— 1 hour	—	—
N <sup>o</sup> 1	0.67 %	1.17 %	3.20 %	3.24 %	3.32 %	8.73 %	10.69 %	47.05 %	4.48 %
N <sup>o</sup> 2	1.51	2.35	4.20	4.59	4.46	9.18	9.63	47.10	3.17
N <sup>o</sup> 3	0.16	0.22	0.92	0.45	1.25	3.92	8.51	44.50	4.29
N <sup>o</sup> 4	3.75	4.42	5.60	6.49	7.02	10.97	11.92	48.40	2.70
N <sup>o</sup> 5	2.24	3.24	6.20	5.88	5.63	9.29	10.52	47.26	3.02
N <sup>o</sup> 6	4.08	5.07	5.73	6.04	5.25	13.10	12.32	46.81	8.12
N <sup>o</sup> 7	3.08	4.17	4.78	7.56	5.52	10.41	11.64	43.70	7.74
N <sup>o</sup> 8	1.12	1.45	2.19	2.46	2.83	11.53	7.67	44.25	4.38
N <sup>o</sup> 9	2.12	2.35	3.36	8.28	5.76	12.88	9.29	41.15	9.05
N <sup>o</sup> 10	3.36	5.16	6.94	8.62	6.96	11.87	7.39	47.72	3.73

The samples chosen represent the most varied types of basic slag used in agriculture. The determinations made were as follows:

- 1) Lime (CaO) soluble in distilled water.
- 2) Lime soluble in water containing 5 % sugar.

[1275-1276]

- 3) Lime soluble in sweetened water after decarbonisation by heating.
- 4) Lime soluble in 2 % phenol (LINDET process).
- 5) Lime removed by a neutral solution of humate of ammonia (titrated in the form of calcium oxide after calcination).
- 6) Lime soluble in chloride of ammonia, cold, at various concentrations (titration of ammonia set free).
- 7) Lime removed by a saturated solution of carbodioxide (titrated alkalimetrically);
- 8) Total lime soluble in mineral acids.

There are 2 phases in the reactions obtained: during the first a certain quantity of lime passes into solution in a comparatively short time; in the second, a slow and continuous solution for 5 days is observed.

The figures given are therefore conventional; but they represent to a considerable degree the lime which is easily dissolved in the first phase.

From these results the following general conclusions may be drawn:

1) Lime, properly so-called, only exists in small quantities (1-3 % on an average) in the basic slag; it also diminishes by formation of the carbonate when exposed to the air.

2) Complex silicates capable of setting free lime rather slowly under the action of pure water, more easily under that of sweetened water, of a solution of humate of ammonia or of phenol, exist in basic slag. When ammonium chloride or carbon dioxide in saturated solution is present, the lime is dissolved in two phases: in the first,  $\frac{1}{3}$  of the lime dissolves rapidly, the phenomenon then continuing much more slowly. The quick-lime set free only represents therefore a small part of the lime in the basic slag which helps to make the soil alkaline. Further, it is clear that the basic slag in this respect may have on the one hand, an almost immediate effect, and on the other, the action may last a certain time.

The constant presence of magnesia, coming from refractory substances present in basic slag, should also be noted. The quantities varied from 3 to 15 %, with an average of 8.9 % for 25 samples. A considerable part dissolves in 2 % citric acid.

It is not without interest, from the agricultural point of view, to point out that basic slag may supply the soil, in an easily assimilable form, with the manganese which may be lacking. It generally contains 4-5 % of total manganese, easily soluble in 2 % citric acid and partially so in all the weak agents above mentioned. An application of 500 kg. of basic slag per ha. therefore represents an average supply of 25 kg. of the metal manganese.

A. de B.

1277 - **The Potassic Deposits of Catalonia, Spain.** — PESSA G., in *L'Industrie chimique* Vol. IX, No. 104, pp. 387-389. Paris, September 1922.

The first news of the discovery of potassic deposits in Catalonia in 1917 caused a great sensation in Spain and other countries, and a keen competition immediately between Companies and individuals at home and abroad to acquire possession of thousands of hectares of land in the mining district

[1276-1277]

The first investigations of R. ETIENNE, Professor at the School of Mines in Paris, shewed that the deposits of the Catalonia basin can bear comparison with those of the best German mines and are superior in so far that they lie much nearer to the surface of the soil. On October 1, 1914 when 101 215 hectares of the land had already been sold, the Spanish Government reserved for itself the ownership of all that remained of the basin. A law drawn up on the following bases came into force in June 1918.

- 1) The obligation of owners to prospect and exploit their mines ;
- 2) The privileges given to prospectors (the mining dues to be paid at the lowest fixed by the law) ;
- 3) State control and intervention on the following points ;
  - a) manufacture, production and sale of potassic fertilisers ; fixing the maximum and minimum quantities to be extracted annually ;
  - b) maximum sale price on the Spanish market ;
  - c) maximum amount to be exported and minimum prices to be asked on foreign markets.

By this frankly protectionist law the Spanish Government was only following the example of the Government of Sweden, which had similarly controlled the exploitation of its iron, of Germany as regards potash and the United States as regards phosphates.

After the passing of this law, the exploitation of the mines was carried with increased activity, especially by the State and the Solway Company which made 13 borings in the Suria district, and sunk a well 9 m. in diameter and 231 m. deep.

The potassic deposits rest on the lower oligocene of the Provinces of Barcelona and Lérida in the Communes of Berga, Vich, Igualada, Balaguer and Isona ; the richest district is towards the east, and has been reserved for the Government. The beds which are between 300 and 500 m. thick are probably derived from a large oligocene lake which, as it dried up, deposited the salts.

The first salt deposited was anhydrite which indicates a very high temperature and great concentration of sodium chloride.

Next came a thick mass of pure, well crystallised sodium chloride upon which was imposed a layer of sylvine and one of carnallite mixed with sodium chloride. The whole set of deposits is protected by a series of marls, sands, and fine limestones in the following order : marls and sands 10 to 80 m. thick — alternate layers of marls and common salt — a layer of ash 60 to 80 m. thick of which 30-35 metres are composed of potassic sands containing 10% of potassium ( $K_2O$ ) — a 10-12 m. layer of which 10 m. are sylvine — a bed of white sodium chloride about 200 m. thick and finally 2-10 m. of anhydrite and marine limestone.

MARIN, a mining engineer, has estimated the amount of potassium ( $K_2O$ ) only in the Lucia district (10 km<sup>2</sup>) at 10 million m<sup>3</sup> ; the pre-war value of this deposit was 3790 million *pesetas*. MARIN'S estimate is however regarded as too low.

The total reserved area measures 440 000 hectares, of which 100 000 are sold to private individuals and the remainder to the Government.

The extent of the whole workable area is now reckoned at 60 km<sup>2</sup> and the beds are considered to be richer in potassium than the German and Alsatian deposits. The carnallite is almost pure, and has yielded 20.60 % potassium chloride and 34.19 % magnesium chloride. The sylvinite contains 67.20 % potassium chloride and 28 % sodium chloride.

The potassic salts industry is still in the rudimentary stage. Its development is at present checked by two classes of difficulties. The first is of a secondary and transitory character and depends upon the following facts: 1) the depreciation of the German currency; Stassfurt salt costing 200 marks a ton to make, are only worth 5 pesetas on account of the low exchange, whereas Catalonia salts cost 20 pesetas — 2) the Hamburg-Barcelona freight rate is 10 pesetas per ton, whereas the Barcelona-Vallencia rate is 20 pesetas — 3) the Spanish miner is unaccustomed to his work and his output is therefore low; he is however paid 5 or 7 pesetas, whereas the 70 marks earned by a German miner are only worth 2 pesetas.

Among difficulties of a more permanent nature must be mentioned the want of strong Companies backed by a considerable amount of capital, not only to work the deposits, but also to build a large aqueduct to carry the waste magnesium water to the sea, for there are no large rivers in Spain like those in Germany, and 500 litres of water per ton are needed to free the carnallite from magnesium chloride which is most injurious to plant life.

In 1913 Spain used 38 kg. of potassic salts per km<sup>2</sup> or 100 000 tons, whereas in Germany 1350 kg. were applied per km<sup>2</sup>. The agricultural consumption of potassic salts in Spain could be brought up to 100 000 tons which would mean the extraction of 1 million tons of the mineral. In order that these salts may be sold at a low price in the country, 3 to 4 million tons must be exported annually. Although the deposits are rich enough to furnish such an amount, it will need many years and much more intensive work before this figure can be reached.

The Spanish Government has authorised the export of potassic salt as soon as the home requirements, amounting to 10 000 tons, have been assured.

A. de B.

1278 - Progress of Nitrogen Fixation after the War. — HARKER, V. A., in *Chemical Industry*, Vol. XLI, No. 18, pp. 387-390. London, September 30, 1921.

The arc process has been greatly improved by the substitution of air containing 50 % oxygen for normal air; the product is no longer absorbed in the towers, but is extracted in liquid form.

The synthetic ammonia process is the method that has most developed. The first system, which is the one used in Germany, was invented by HARBERT but this has been followed by many others as can be seen by reference to the appended table.

The cyanamide process, which is often regarded as a little out of date, produced more nitrogen than any of the others. Many factories opened during the war are now shut down as they are too costly to use for the production of fertilisers; amongst them is the American Alabama

Country and date	Process	Pressure used in atmospheres	Production in kg. per litre and per hour	Approximate ammonia percentage	Method of ammonia extraction	Source of the hydrogen	Observations
Germany (1913)	Haber-Bosch (BASF and Co.)	200	0.3-0.5	7-8 %	a) cooling. b) solution in water.	Water gas. Catalytic process.	Very large unit, speed of gas low, circulation. Preliminary cooling. Operation on large scale.
England (1917)	Munitions Ministry (Greenwood and Co.)	150	5-20	2-4	Solution with temperature cycle.	Idem.	Much higher gas speed. Electric heating. Only as an experiment.
(1921)	Synthetic Ammonia and Nitrates Ltd. Brunner Mond and Co., Billingham.	—	—	—	—	—	Experimental plant producing 2 tons a day.
Unit. States (1918)	General Chemical Co. (Sheffield, Alabama)	less than 100	about 0.4	8	Cooling to 30° or 40° C.	Catalytic process with water gas.	Government Establishments can turn out 11000 tons of nitrogen annually. Not working at present.
(1920)	Aten. Nit. Corp. Solway Process Co., Syracuse.	—	—	—	—	—	Circulation. Daily output 10 tons of ammonia.
France (1920)	Claude, . . . . .	900-1000	about 5	25	Condensation by pressure and temperature.	Various.	Without circulation. Daily output 5 tons. 3 plants in series.
Italy (1922)	Casale (Soc. Idross. Terrib.).	about 500	—	—	Solution . . . . .	Electrolytic.	Daily output 4 tons.
(1922)	Fraser . . . . .	—	—	—	Solution . . . . .	Electrolytic.	—
Norway (1921)	Cedberg . . . . .	—	—	—	—	—	—

[1278]

factory which is the largest in the world having an annual output of 200 000 tons.

More or less success has been obtained by various processes for transforming calcium cyanamide into a better fertiliser such as mono-ammoniac phosphate (Ammophos), urea, phosphazote (with 11-12 % of nitrogen in the form of urea and 11-12 % phosphorus anhydride). A process based upon the transformation of cyanamide into cyanide is now gaining ground in America. The annual output of Germany, at the end of this year will amount to 500 000 tons.

A. de B.

1279 - **Advantages of Bicarbonate of Ammonia as a Fertiliser, both from the Point of View of its Production and of its Use.** — GLUND, W., in *I. Chemiker-Zeitung* Vol. XI, XVI, No. 92, pp. 693-697. Cöthen, August 3, 1922. — II. *Ibidem*, No. 9, pp. 715-717, August 10, 1922.

I. — Bicarbonate of ammonia, which contains 17 % of nitrogen and consequently 21 % of ammonia, has not yet been largely used in agriculture, though it has been frequently suggested. There are various prejudices against its more extended use, among which is an exaggerated fear as to its volatility. These prejudices should disappear in the face of actual farming practice, and also because, owing to conditions in Germany there is a restriction on the consumption of sulphuric acid. Several German agricultural stations had very favourable results from experiment made in 1921.

The chief advantages of bicarbonate of ammonia are the following: it does not necessitate, like sulphate of ammonia, the saturation of the soil with useless or injurious matter: in sulphate of ammonia 300 kg of sulphuric acid per 100 kg. of ammonia are required; 75 % thereof is not utilised. In 1909, 322 000 tons of sulphate of ammonia were applied to the soil, representing 239 000 tons of sulphuric acid, which, under present conditions, would be very expensive. Further, and this is still more serious, sulphuric acid transforms the lime of the soil into gypsum and acidifies it: potash and phosphate fertilisers lose their efficacy if this disadvantage is not avoided by liming; free sulphuric acid often is found, which damages roots, etc. Chloride of ammonia, which is more economical than the sulphate and is therefore coming more and more into use, also possesses disadvantages: the chlorine combines with the calcium of the soil and forms a soluble chloride of calcium, which is carried away by the rain, and the soil "cools".

Besides these negative advantages all the components of bicarbonate are useful: carbonic acid is one of the most important fertilisers and its action is exercised on the roots as well as the leaves. Further, carbonic anhydride costs next to nothing and may be had in unlimited quantities.

Bicarbonate, owing to its fine but not powdery consistency, may be easily spread over the soil, and even after a long period does not become clotted; on the other hand, carbonate has given bad results, for it forms into hard lumps, and the fact that farmers have often mistaken it for bicarbonate has been prejudicial to the latter.

[1278-1279]

There remains the great objection of volatility, but it has been much exaggerated. It has been proved that up to 50° and under unfavourable conditions, bicarbonate of ammonia loses almost exclusively carbonic hydride, and only 0.12 % of ammonia on changing into sesquicarbonate. It may be used as a fertiliser mixed with superphosphate, in which case it is fixed by the acidity of the superphosphate. It may be kept about a year in the ordinary packing without appreciable loss, provided the atmosphere is dry. More impermeable packing may be used than the ordinary boxes and canvas bags. Excellent results have been obtained with paper bags prepared with a special resinous solution. Altogether it may be estimated that from the time of its storage in the factory until it is applied to the soil, less than 5 % is lost. Moreover sulphate is also volatile to a certain extent.

From the industrial point of view it is advantageous in all respects. Ammonia is obtained by direct synthesis by means of the HABER process; carbonic anhydride is a by-product of gas-works and the HABER process; the disadvantages attendant on the use of sulphate in farming have already led to an examination of the question of producing urea on a large scale; it is a neutral fertiliser, but the process of manufacture is complicated; also, the starting point in the process is bicarbonate of ammonia which, consequently, will always be the more economical.

II. — The writer afterwards examines the various industrial manufacturing processes of bicarbonate of ammonia, shows their simplicity compared with those of other nitrogenous fertilisers and draws attention to their economic advantages. Supposing a factory has a daily output of 1000 kg. of ammonia, the latter would cost, according to its various combinations:

Sulphate of ammonia . . . . .	11 890-19 790	mks
Nitrate " . . . . .	19 783	"
Chloride " . . . . .	17 313	"
Bicarbonate " . . . . .	8 402	"

Further, in contrast to the other manufacturing processes, that of bicarbonate would be independent of several variable factors, such as the price of sulphuric acid, that of nitric acid, etc. The manufacture of bicarbonate, however, cannot be developed in Germany yet as it should be on account of limitations imposed by the War.

A. de B.

- Chloride of Ammonium as Manure. — MAUME L., in *Le Progrès agricole et viticole*, Vol. 39, No. 25, pp. 588-592. Montpellier, June 18, 1922.

The writer gives an account of experiments made at the National School of Agriculture at Montpellier on two series of plots: in the first the manuring was done 10 days before sowing and in the second series the same day as the sowing. The plots were treated with various nitrogenous manures to the extent of 60 kg. of nitrogen per ha., and then sown with wheat. Taking the yield of the control plot, which was not



manured, as equal to 100, the results with the various manures were given in the following Table: —

*Results of the manuring experiments.*

Plots	In the first series		In the second series	
	Total weight of the crop	Weight of the grain	Total weight of the crop	Weight of the grain
1. Control . . . . .	100	100	100	100
2. Cyanamide of calcium . . . . .	120	148	102	108
3. Nitrate of soda . . . . .	143	178	136	170
4. Nitrate of lime . . . . .	134	152	115	145
5. Nitrate of ammonia . . . . .	131	153	116	148
6. Sulphate of ammonia . . . . .	128	152	117	148
7. Chloride of ammonium . . . . .	134	154	123	150

Chloride of ammonium is therefore comparable with sulphate of ammonia, nitrate of ammonia and nitrate of lime and it could be used to great advantage as soon as it can be obtained at a more reasonable price.

The data in the Table above show that generally there is great advantage in manuring before sowing, especially in the case of cyanamide of calcium, which had only a negligible effect in the second series, while it proved very effective in the first.

A. de B.

1281 — **Arsenic and its Uses in Agriculture.** — ROBERTSON, F. J. (Vice-President U. S. Resining and Mining Company), in *Engineering and Mining Journal-Press*, Vol. XLII No. 20, pp. 368-369. New York, May 1922.

Arsenic is generally found, like sulphur, associated with metals. Of 130 minerals, or 12 % of the known minerals, contain it. The principal producing countries are Germany, France, Portugal, Spain, England, Turkey, Mexico, Canada, Japan and the United States.

In the United States white arsenic (arsenious anhydride) is collected as a by-product in the foundries of the West. Sulphurous and arsenious gases are precipitated and refined in special furnaces and give a product containing 99 % or more of arsenious anhydride. White arsenic is chiefly used in the manufacture of insecticides, for destroying weeds and for disinfecting large and small animals. Some horticulturists and arboriculturists use arseniate of lead for spraying the ground.

Weeds, especially along the railway lines are destroyed by means of large applications of arsenic. In 1920 in the United States 15 000 tons were used; in 1921, not more than 9000 tons. Before the war most of it was exported; from 1901 to 1910 the United States produced large quantities and exported 4240 tons. The annual consumption rose from 3400 tons in 1904, to 15 000 tons in 1920.

Arseniate of calcium has proved very effective against the cotton boll weevil and as the latter has invaded all parts of the United States where cotton is grown the demand for arseniate will greatly increase.

properly prepared, the arseniate does not injure the plants like Paris green, as it is less caustic; 3 to 5 applications of arseniate, at intervals of 4 or 5 days, to the extent of 5 to 7 kg. per ha., suffice. Owing to the use of arseniate it cannot be profitably used on land which, under good conditions, does not produce at least 5.5 kg. of cotton per ha. If the use of arseniate became general in cotton plantations it would absorb the whole American production of arsenic, allowing for a consumption of 15 to 28 kg. per hectare. At the present moment the chief difficulty is to find an effective method for its application. The present consumption of arsenic is estimated as follows:—

In the glass industry . . . . .	2500 to 3000 tons
For disinfecting cattle, about . . . . .	1500 "
In the manufacture of paints and other uses, about . . . . .	500 "
In the preparation of insecticides and fungicides . . . . .	5000 to 9000 "

White arsenic is sold in barrels of 2 qx. or in packets of from 0.5 kg. to 5 kg. Many States buy arsenic wholesale and let the farmers profit from the lower price. The production of arsenic has now reached such a level that, unless the demand for the manufacture of insecticide increases materially, there will be a surplus production for export. The agricultural consumption of arsenic increases every year, its efficiency as an insecticide being more and more appreciated.

A. D. B.

32 - **Selection and Treatment of Waters for Spraying Purposes.** — DEONG, R. P. in *University of California Publications. College of Agriculture, Agricultural Experiment Station, Berkeley, California*, Bulletin No. 358, pp. 301-311, figs. 2. Berkeley, California, December 1921.

Hard water forms dangerous combinations with or destroys the efficiency of many forms of insecticides. Such waters are very common, especially in the west of the United States. Their distribution and degree of hardness is however a matter of which the knowledge is approximately.

Softening hard waters by means of caustic soda or other water softeners is not completely successful in all cases, and hauling soft water from a distance in quantities sufficient for spraying purposes is frequently impracticable. Surface waters are usually softer than underground supplies, but storage of surface water during rainy seasons is possible only in limited areas.

Water softening plants may be installed at a cost of a few hundred dollars with a sufficient capacity for supplying a spraying outfit and also meeting the ordinary needs of the home.

The use of dusting materials in certain cases in place of liquid sprays, offers an advantage in that the user is independent of the type of water.

Insecticides, compatible with the soluble salts commonly found in waters are valuable and may be a satisfactory solution of the difficulty in some cases.

Water containing chlorine at the rate of 20 parts per million or more

has been reported as dangerous to use with acid arsenate of lead, a soluble form of arsenate being formed, which may cause severe injury to foliage. Basic arsenate of lead should be substituted for the acid type, if used with very hard or alkaline waters.

Californian waters have an unusually high chlorine content, which may account for cases of arsenical injury that have occurred where acid arsenate of lead has been used.

A. d. B.

1283 - On the Presence of Cobalt and Nickel in Plants (1). — BERTRAND G. and MOKRAGNATZ M., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 11, pp. 458-460. Paris, Sept. 11, 1922.

The writers while carrying out their experiments on nickel and cobalt in the soil have succeeded in determining these metals, as well as copper and zinc which accompany them, quantitatively in samples of soil of about fifty grammes weight.

They also analysed the ashes of 20 samples of different species of plants, using for preference the portions which are used for food:— carrot, onion, potato, spinach, lettuce, cress, tomato, apricot, lentils, kidney-beans, buck-wheat, wheat, oats, maize, rice and chanterelle. They analysed 1-2 kg. of the different plants; the cobalt was separated in the form of cobalto-nitrite of potassium and the nickel in combination with dimethylglyoxin.

Positive results were obtained for nickel with all the plants and for cobalt with all except carrots and oats. The cobalt varied from  $\frac{1}{200}$  of a mgm. to 0.3 mgm. (buckwheat) per kilogramme of fresh matter; nickel from 0.01 mgm. (tomato) to 2 mgm. (peas).

It remains to be ascertained whether the presence of these metals in the plant organism is only passive, or whether it supplies a physiological need.

A. de B.

1284 - Biochemistry of *Sclerotinia cinerea*. — WILLAMAN, J. J., The Function of Vitamines in the Metabolism of *Sclerotinia cinerea*, in *The Journal of the American Chemical Society*, Vol. 42, No. 3, pp. 945-985. 8 fig. Easton, Pa., March 1920. — II. WILLAMAN, J. J., Pectin Relations of *Sclerotinia cinerea* in *The Botanical Gazette*, Vol. LXV, No. 3, pp. 221-229, bibliography of 10 publications. Chicago, Ill., September 1920. — III. WILLAMAN, J. J., and SANDSTROM, W. M., Biochemistry of Plant Diseases, Effect of *Sclerotinia cinerea* on Plums. *Ibidem*, Vol. LXXIII, No. 4, pp. 287-305, 7 figs., bibliography of 54 publications. April 1922. — IV. WILLAMAN, J. J. and DAVISON, F. R., Biochemistry of Plant Diseases, Proximate Analysis of Plums Rotted by *Sclerotinia cinerea* *Ibidem*, Vol. LXXIV, No. 4, pp. 104-109, 2 figs., bibliography of 6 publ. Sept. 1922.

I. — The writer determined to make researches on the biochemistry of parasitic fungi. For this purpose he chose *Sclerotinia cinerea* (Bon.) Schröter, for it develops well even in the saprophyte state, which facilitates study in the laboratory, where it may be cultivated under artificial conditions.

In the first series of experiments the writer ascertained the conditions

(1) See R. Nov. 1922, Nos. 1016 and 1033. (Ed.)

f growth. CURRIE had already experimented with this object in view of *Aspergillus niger*. Results showed that this fungus grows luxuriously and fructifies in media containing saccharose, nitrates and salts which furnish potassium ions, magnesium, sulphate and phosphates.

The writer's researches prove that *Sclerotinia* has greater needs: defined chemical elements are not sufficient, even if nitrogen is supplied in the form of amino-acids or asparagine. It absolutely needs *vitamines* and factors accessory to growth.

The writer uses this term because it is consecrated by use in scientific and ordinary literature, though it is not certain that the substances spoken of here are of amine structure. It is a question of substances necessary for the accomplishment of organic functions but which take no direct part in vigorous and material exchanges; evidently there are several kinds: A, B, C.

Indispensable to animals which are incapable of producing them, they are supplied directly or indirectly by plants. It is doubtful whether they are phyto-genous; according to the researches of BOTTOMLEY and other writers, plants themselves utilise symbiotic bacteria, *i. e.* those living in the soil, or the supply of these essentials or of similar substances termed *auxinones*. APPLEMAN maintains that in potato tubers there are substances of this nature, indispensable to the vigorous growth of the young plants, hence very small seedling potatoes should not be used.

Many inferior forms of life are capable of producing *vitamines*; for instance, the typhus bacilli, according to PACINI and RUSSELL, develop a *vitamine A*, *i. e.* of growth, which would explain the increase in weight and size observed in many young subjects after an attack of typhoid fever. Other inferior forms of life, on the contrary, must exhaust the *vitamines* in their surroundings. This has been proved by WILLIAMS in the case of the bread-making blastomycetes. In the absence of *vitamines* their growth ceases; the *vitamine* content of flour may be estimated by noting the rate of increase of the yeast cells. LLOYD has proved that even meningococci only increase where *vitamines* are present. Similar facts have been observed by DAVIS in the case of the Pfeiffer or influenza bacillus.

The writer then points out that the behaviour of *Sclerotinia* is very similar. This Hyphomycete must have *vitamines*, which should be in the surrounding medium, for instance in fruits. In artificial culture, *Sclerotinia* develops very much better if the substratum contains fruit juice: that of the peach is the most effective. This is shown very clearly by the accompanying graph (fig. 1), where the two lower curves (184 and 186) represent the development of colonies of Hyphomycetes when fruit juice is lacking. The three elevated curves (183, 185 and 187) show the increased development when plum juice is present.

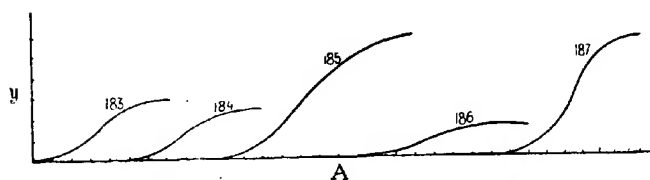
The *vitamines* necessary to the growth of *Sclerotinia* may be extracted from acid liquids by means of fuller's earth, after which they are passed on to alkaline liquids. This isolation process, which was invented by LLOYD for alkaloids, is equally applicable to the *vitamine B*. The pectin

however should be first precipitated with alcohol. In this way the vitamines are freed from many other substances with which they are combined, including some whose action is injurious, like tannin.

By this process the writer has proved that the vitamines necessary to the growth of *Sclerotinia* are contained in many substances: pollen, the terminal buds of legumes, the spores of fungi, hyphomycetes, blastomycetes, milk, pancreatine, etc.; speaking generally, they abound in vegetable tissues endowed with, or capable of, intense metabolism.

The writer raises the question whether the vegetative growth and the reproductive activity of *Sclerotinia* are connected with 2 distinct vitamines. Certain facts favour this hypothesis. For instance, fuller's earth seems to absorb now one, now the other, more rapidly according as the medium is aqueous or alcoholic. High temperatures seem to destroy the principle of vegetative growth more rapidly than that of reproduction.

FIG. 1. — Development of colonies of *Sclerotinia* in cultures of 25 cc. of nutritive solution.



EXPLANATION :

Y = increase in cc. ; A = age in days.

Curve 183 : addition of 2 cm. of plum juice.

» 184 : » of 0.1 gm. of glycine

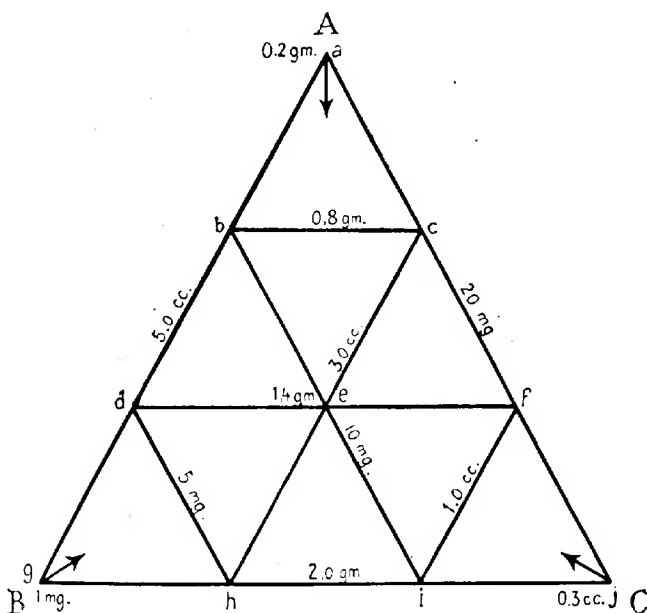
» 185 : » » » and 2 cc. of plum juice.

» 186 : » of 0.1 gm. of asparagine

» 187 : » » » and 2 cc. of plum juice.

Most of the products containing vitamines, enumerated above, seem to favour vegetative growth only, while very few have any influence on the development of reproduction. Certain concentrations favour vegetative growth more than reproduction, as though there were two principles with distinct properties. This latter action is shown clearly by systematically varying the proportions of the principal constituents of the culture according to a system of 3 co-ordinates invented by SCHREINER and SKINNER. (See fig. 2). Each series of co-ordinates corresponds to one of the principal components of the nutritive medium, viz., nitrogen (asparagine), sugar, vitamine (fruit juice); each point of intersection represents a culture made in a medium containing the quantities of nutritive materials shown in the co-ordinates relating thereto. Vegetative growth is measured by the writer from the diameter of the colonies (maximum 6 cm.).

FIG. 2. — Diagram showing the effect of different amounts of sugar, nitrogen (asparagine) and vitamins (fruit juices), on the vegetative growth and spores of *Sclerotinia*.



A = sugar ; B = nitrogen ; C = vitamine

in diameter, does not coincide with the zone of the greatest spore development, marked by a line corresponding to the 3.5 degree. The vitamine which stimulates reproductive activity therefore seems to act differently from that which stimulates vegetative growth. The varying action of these principles is not modified by varying the proportions of the other constituents. If the vitamines which cause increase in reproduction are in excess, they limit the action of those which favour vegetative growth. This is perhaps because they draw nutritive substances from vegetation by the growth organisms and divert them to the formation of spores.

The writer does not consider that these tests show with certainty the two actions of the vitamins indispensable to the growth and reproduction of *Sclerotinia*. He even believes it possible that only one vitamin comes into action, viz., thermolabile, dialysible through collodion, precipitated by phospho-tungstic acid, widely disseminated throughout nature and which might be identified with the "B" or antineurotic vitamin. In small quantities it only favours vegetative growth. Otherwise, in the earlier periods, it causes an increase of reserves and then favours reproduction. These two actions, therefore, must be two manifestations of one and the same activity. They appear to be connected with the respiratory exchanges. The apparent complications described may be attributed to the coexistence of other substances; for instance, fuller's earth removes toxic substances also which are only active in a highly concentrated form: the latter therefore may be less favourable than weak concentrations to the growth of *Sclerotinia*. The new question raised by the writer as to both actions, or that of growth vitamins alone, must be studied later.

II. — The writer has studied the chemical phenomena which take place when fruit is attacked by *Sclerotinia*.

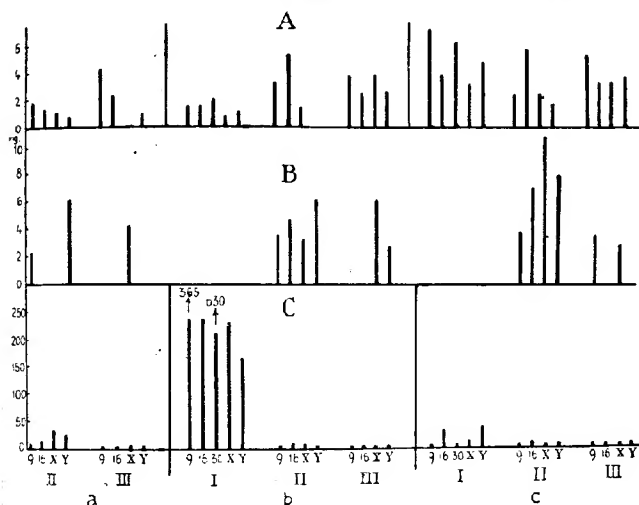
He refers to the previous work of COOLEY, VALLEAU and HAWKINS, nearly all carried out by inoculating healthy fruit with the hyphomycete. The writer, on the contrary, has worked on fruit extracts. He has thus seen that in the absence of sugars, or after having utilised all the available sugars, *Sclerotinia* lives at the expense of the pectin, i. e. of the substance which cements the cells. This action takes place at several periods. Above all, the pectin is rendered soluble by an enzyme, through which the hyphae can insinuate themselves between the cells when the fungus invades a tissue. Afterwards the soluble pectin is coagulated by another enzyme (pectase), which forms pectate of lime, soluble in alkalis and dilute acids and reprecipitated by alcohol. This gel absorbs water, so that the fruits retain their consistency and the injury is less apparent, a characteristic trait of attacks by *Sclerotinia*. Finally, both the soluble pectin and the pectate of lime are hydrolysed, probably under the influence of a third enzyme, *pectinase*. This hydrolysis is accompanied by the assimilation of the constituent of the pectin which contains furfural, of which  $\frac{9}{10}$  disappear but which is not stored in the hyphae, and microchemical tests do not reveal its presence. Reducing sugars are given off. The action of the fungus seems to be favoured by the production of oxalic acid.

III. — The writer has experimented to find out the differences between the varieties of fruits which resist *Sclerotinia* and those which do not as well as the changes produced by the parasite. He has used 5 varieties of plums, of which 3 are resistant (Burbank  $\times$  Wolf 9, Burbank  $\times$  Wolf 16 and Abundance  $\times$  Wolf 30, which are represented in the diagrams by B  $\times$  W 9, B  $\times$  W 16 and A  $\times$  W 30, or more simply by 9-16-30) and 2 sensitive (Compass and Sand Cherry, or C and S C F). He examined them in the following stages: 1) half-growth; 2) full-growth, at the commencement of the ripening period; 3) when ripe (in the diagrams: I, II, III). He divided them into 3 parts: one was examined immediately, the second

after being attacked by the fungus and the last was kept and examined as a check at the same time as the second (in the diagrams: *a*, *b* and *c*).

Those resisting attack all had a thicker skin; but the writer overcame this difficulty by inoculating the spores in suspension in the interior of the fruit by means of a hypodermic syringe to find out if there was no other kind of physiological difference.

FIG. 3. — Oxalic acid and tannin content of some species of plums.



EXPLANATION :

- A = oxalic acid of the juice ;
- B = oxalic acid of the residue ;
- C = tannin of the juice.
- I, II, III = periods of growth.
- a = fresh fruit ; b = preserved fruit ; c = mildewed fruit.

The most resistant varieties are more consistent, contain a more compact pulp and rarely have a higher specific gravity. They are attacked more slowly and show fewer conidiospores.

The previous work of other writers had resulted in excluding the action of tannin or acidity in determining the resistance to *Sclerotinia*.

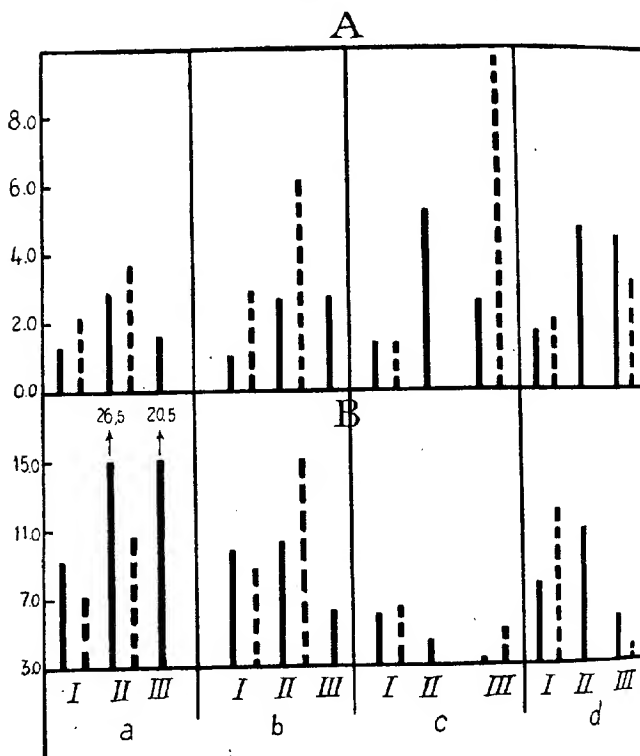
The chemical tests made by the writer show some differences which are not sufficiently marked to explain the differences of receptivity. For instance, the most resistant plums are rather richer in hydrogen ions and



oxalic acid ; but the total acidity is less. Fig. 3 shows the action of oxalic acid and tannin.

The attack by the parasite naturally greatly modifies the composition of the fruits. As shown in fig. 3, in plums gathered from the tree and preserved, there is normally an accumulation of tannin ; the red-brown rot on the contrary, prevents this ; at the same time, it gives rise to oxalic

FIG. 4. — Composition of 4 varieties of healthy and rotten plums at 3 different periods of growth.



EXPLANATION :

A = ether extract ; B = cellulose.

I, II, III = periods of growth.

Continuous lines = healthy samples ; dotted lines = rotten samples.

Varieties : a and b resistant ; c and d non-resistant.

acid. Further, the acidity (true or titratable) decreases. There is a notable increase of protein nitrogen. This is evidently due to the fungus converting into proteins part of the more simple nitrogenous compounds of the fruits and accumulating them in its mycelium.

IV. — Later researches concerning modifications produced by *Sclerotinia* on plums show that the fungus increases the proportion of ash, lime, nitrogen and ether extract; but this action is of little importance, for it is due to the more active evaporation by atmospheric hyphae. The differences between susceptible and resistant varieties was but little marked; the latter proved richer in cellulose and less rich in ash, nitrogen, lime and ether extract (See fig. 4).

As the fruits ripen, organic acids and carbohydrates accumulate, so that there is a corresponding decrease of ash, nitrogen and lime. L. V.

1285 — **Ammonia as a basal and a final Product in the Transformation of Nitrogen by Plants.** — PRIANISCHNIKOW (Agricultural Academy of Moscow), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCIX, Parts 4 and 5, pp. 267-286. Berlin, 1922.

The author suggests that the formation of asparagin in plants is a secondary product of the process of hydrolysis which breaks up the protein molecule, thereby giving rise to amido acids, and that oxidation leads to the formation of ammonia and asparagin. The truth of this hypothesis, which finds a parallel in the digestion of proteids in the animal organism, was later confirmed by BUTKEWITCH. Ammonia would therefore appear to be the final stage in the decomposition of nitrogenous substances, and together with malic acid and to some extent with aspartic acid, is the point of departure for the formation of asparagin.

By his former work the author has proved that barley-seedlings can convert ammonia almost completely into asparagin; on the other hand, the development of pea-seedlings is hindered by ammonium salts *e. g.*, chloride and sulphate, but if these salts are neutralised by calcium carbonate, pea-seedlings also can transform ammonia into asparagin.

The author describes some of his experiments on *Vicia sativa* and *Zea Mays*; the former behaves like the pea, and the latter like barley. The different behaviour of the two families must not however be deduced from this fact. Yellow lupins give quite unexpected results; in these plants, which are rich in ammonia, no asparagin synthesis ever takes place even in the presence of calcium carbonate; when supplied with ammonium salts, the lupins show a decrease in total nitrogen and also in asparagin. This diminution increases with the amount of ammoniacal nitrogen present, and may perhaps be due to loss caused by drought. In the case of lupins, it appears that ammonia replaces asparagin as a final product. Not only is there no synthesis of ammonia at the expense of the external ammonia, but the amount of asparagin produced by the protein substances of the plant is also diminished. If the sulphate and chloride are replaced by the phosphate and nitrate of ammonium and urea added (which quickly produces ammonia in plants), the asparagin synthesis proceeds without any hindrance.

The cause of the different behaviour of lupins must be attributed to the difference in their chemical composition; these plants contain the largest amount of protein substances, and whereas in Gramineae, the relation between protein substances and carbohydrates is 1:6, it is 1:2 in other Leguminosae, and 1:0.6 in lupins. Hence it may be concluded that carbohydrates and fats promote the synthesis of asparagin. This has been proved by other experiments in which by diminishing the carbohydrates in barley (deferring the examination of the seedlings from the 10th to the 12 day), the author obtained a result similar to that in the case of lupins. On the other hand, by increasing by other means the carbohydrate content of the lupins, the author made them act just like other plants.

Whereas the animal organism normally converts ammonia into urea which can be evacuated without any loss, plants neutralise ammonia by producing asparagin which accumulates in the plant sap to be again used in the synthesis of albumen.

Light exerts no influence upon asparagin synthesis. A. de B.

1286 - Pedigree Selection of Göttingen Rye (Germany). — SEEDORF, W., in *Journal für Landwirtschaft*, Vol. 70, Parts II-III, pp. 163-190. Berlin, 1922.

Göttingen rye was obtained from Böhmerwald rye. As long ago as 1879, DRECHSLER began his work by choosing out the best ears, but it was not until 1890 that with LIEBSCHER any individual selection properly so-called was attempted. The improvement and selection work has already extended over a period of more than 20 years and has been the object of unremitting attention on the part of Prof. VON SEELHORST, for 25 years Director of the Göttingen Agricultural Institute.

Göttingen rye is very productive; in good years, when it does not lodge or suffer from cold during the winter, the yield may be 40 hectolitres per hectare. It tillers freely, so that although the weight per 100 grains is considerable (4.5 gm.), the amount of seed corn required per hectare is only 66 kg. On the other hand, the straw is very long, which inclines it to lodging, and the ears are too loose.

In the work analysed, the author gives the results of a series of experiments carried out between 1905 and 1921 with the express object of eliminating the two above-mentioned defects. As material, line 7 was used and the following characters were taken into account: length, thickness and number of internodes, weight, length and density of ear, number of grains set, and percentage of sterile flowers, percentage of grains and weight of 100 grains.

Some improvements have been obtained as regards the thickness of the culms (vigour), the weight, density and setting of the ear. The grain percentage, weight per 100 grains, and length of ear have however not been altered, and all attempts to obtain shorter culms have proved in vain. The selection work, although persevered in for a considerable period of time, has in no wise modified the coefficient of the correlation between the different characters.

As was said above, the objects aimed at were only partially secured.

he cause of this want of success may perhaps be attributed to the existence of a correlation opposed to the aim of the work. In fact, a positive correlation has been observed between the length and thickness of the culms and the length of the culm and the weight of the ear, so that by increasing the latter, which was the object of selection, the length of the straw was so increased, a result quite opposite to what was desired. In both cases, however the correlation coefficient was so low ( $r = 0.2-0.3$ ), as to be unable of itself to offer any serious hindrance to the progress of the work. The number and density of the ears, and the weight per 100 grains are not correlated with culm length and vary independently of it.

A high correlation coefficient (from  $+0.25$  to  $+0.612$ ) is met with between straw length and the number of internodes; in order to obtain short types, it would be necessary to give the preference to forms with few internodes. In any case however a correlation of this sort, although the coefficient is high, cannot be regarded as forming a certain basis for selection.

Ear weight is in positive correlation with culm thickness, length of ear, fertility and weight per 100 grains; as regards culm thickness, it is not only in correlation with the weight of the ear, but also with the density and length of the ear. This correlation should assist the work of selection.

On the whole, it may be said that if on the one hand, the correlations noted of themselves form a hindrance to the attainment of the aims of selection, on the other hand they do not offer the large amount of choice that is generally available.

The existence of correlations can be used in the preliminary field-work, in the laboratory the biometric data of each character are surer guides.

The experiments mentioned in this article were confined to the individuals of a single line; all cross-pollination therefore was necessarily excluded, but although there was danger of a progressive increase in the homozygote, it cannot be said that any bad consequences resulted. G. A.

87 - Trade in Forage in belligerent Countries. — LOPPIORE G., extract from *Le Stazioni Sperimentali agrarie italiane*, Vol. LXXIX, pp. 179-185. Modena, 1922.

These notes form one of the articles published in *Le Stazioni Sperimentali Agrarie italiane* on the "Solution of the Agricultural problems caused by the war".

Trade in seeds depends largely on the knowledge of their origin: this may be determined by the presence of the seeds of weeds growing among the forage plants. But although it is easy to recognise the origin of seeds of pure species, it is somewhat difficult to find out the origin of mixtures with cheaper seeds of bad quality, which are common in trade.

In Italy the seed trade has never been sufficiently considered, because up to the present, no trouble has been taken to do more than ascertain the germinative power and the presence of seed of dodder, whereas elsewhere searches of practical importance have been made regarding the origin and selection of the seeds. It now remains to be seen whether the old

method of determining the origin, based on the presence of seeds of weeds, can be corroborated by the method based on the presence of mineral particles of the soil. For if the methods in which the fraudulent mixing of seed is carried out have succeeded in eliminating the seeds of weeds they will be equally successful in the case of mineral particles.

Among the most important Italian seeds are those of violet clover and lucern. The former is recommended in Germany by WITTMACK, because of its moderate price and its resistance to parasites, while it is discredited by others who prefer to abandon meadows rather than sow plants incapable of standing the rigorous winters of the North.

Excluding certain infesting plants (*Helminthia echinoides*, *Arthrolobium scorpioides*, *Lotus corniculatus*, *Phalaris paradoxa*, *Andropogon halepensis*) sulla has lost, as an associate of violet clover, much of its importance from the experimental standpoint. It gives place to lucern and meadow clover, which are spreading in the Marches and Romagna, whence they are exported in large quantities, while on the other hand, they are spreading in Spain and in the South of France. In reality violet clover, which has been sold, for reasons connected with the war, under various names (Apennine red clover, red clover of the mountains of Upper-Italy) as an essentially southern species, does not exhibit, in relation to slight differences of altitude, such clear variations as those of seeds of the North and South of France. This fact suggests that Italian seeds should not be considered to possess the characters of French seeds from the North or South. For war reasons, seeds from the Argentine, passing through France, were also introduced later under the French name. Italian lucern attracted the attention of the German inspectors because it was suspected that seed from Provence was sold as Italian lucern and the latter in its turn as lucern from Turkestan. These inspectors quickly recognised Turkish origin, owing to the presence of *Acroptilon repens* L., one of the Composite very common in the East. Certainly, for the purpose of identification of species seeds of sulla have not the same importance for lucern as for violet clover; they however allowed Italian origin to be recognised.

On the other hand, *Andropogon halepensis* is rarely found in lucern seeds, so that it has not the same importance for their identification as for violet clover. *Silene dichostoma* Ehrh. formerly characteristic of the flora of Russian meadows, has spread into Silesia and Southern Germany; it therefore makes these Provinces suspect also, but it is no longer typical of Russian seeds.

After all if it is of little importance to know that seed is from Provence or Italian; it is, on the contrary, important to know Asiatic origin, and this is also easily identified. As a matter of fact, out of 10 samples of native lucern, 5 were Italian, 3 from Turkestan and from Southern Europe, that is to say without traces of spontaneous seeds of Italian origin.

Russian and Hungarian seed, which are easily recognised when separate, present difficulties for determining their origin when mixed.

After all, the fact that no dodder seed was found is creditable to Ital-

an merchants who have thoroughly understood how to remove the dodger from their seeds before export.

Foreign botanists have certainly generalised too much in considering as characteristic of the flora of Italian meadows, plants common to various places of origin introduced into the country owing to trade facilities and their aptitude of adapting themselves to different environments. And in this way the number of ubiquitous species has considerably increased, so that certain indications, which were formerly positive, have gradually become negative, losing much of their diagnostic importance.

The German agricultural press recommends that seeds of forage plants should be grown in Germany so as to avoid the necessity for recourse to imported seeds.

G. L.

288 - **Autumn Cereals in Morocco.** — *Annales de l'Institut Colonial de Bordeaux*, pp. 108-115. Paris-Bordeaux, April 1922.

In Western Morocco, autumn cereals cover about 1,750,000 ha., out of a total sown area of 2,140,000 ha., or 82 %; of these cereals barley occupies about 900,000 ha., wheat 800,000 ha. and oats 4000 ha. These areas however vary from one year to another.

**BARLEY.** — Barley is exclusively represented by *Hordeum vulgare* var. *tetrastichum*; in a very few localities a variety with naked grain (*H. nudum*) is found; *H. distichum* or brewer's barley, is non-existent; the local varieties however can be used for making certain beers if the seasons are favourable, and they are able to find a market in France or in England. Their composition is very homogeneous; the most marked variation is found in the content of nitrogenous matter, which may vary from a minimum of 8.75 % to a maximum of 11.94 %.

Barley is mainly used for feeding cattle, but in times of scarcity it is also used for human food. Methods of sowing and cultivation are imperfect; if they were improved the crops would be very much more abundant. Calcareous-clay soils are suitable for these varieties of barley, but they are grown generally.

On December 1, 1921, the price of barley was 35 fr. per quintal at Casablanca, 40 fr. at Rabat, 30 fr. at Meknès, 25 fr. at Marrakech, 32<sup>fr.</sup> 50 at Magazan, 31 at Safi, 30 fr. at Mogador, 35 fr. at Fez, 34 to 39 fr. at Oudjda.

**WHEAT.** — The wheat crop is almost as important as the barley crop. The local varieties belong exclusively or almost exclusively to hard wheats; soft wheat was introduced after the French occupation and covers 16,440 ha. only, out of a total area of 733,121 ha. under wheat. There are about fifteen types of wheat in Morocco, often mixed in the crops, with a fairly high content of nitrogenous matter, varying between 12.31 % and 13.87 % and it is very nearly the same as in the best hard races. An improvement in cultural methods, a good choice of seed, and selection would increase the yield considerably. The yield varies round about 7 qx. per ha. and is higher than that obtained in Tunisia. The Arabs distinguish certain varieties

which are being tested to ascertain their agricultural value, notably "Tréa" and "Asker".

Year	Hard wheat		Soft wheat	
	Area	Yield	Area	Yield
1918 . . . . .	774 331 ha	6 090 116 qx	10 574 ha	86 945 q
1919 . . . . .	842 948	4 384 696	12 743	76 235
1920 . . . . .	775 808	4 770 184	11 041	72 869
1921 . . . . .	766 679	6 118 051	16 442	141 671

Soft wheat was unknown before the French occupation: the yield which was 75 000 qx. in 1920, increased to 178 000 qx. in 1922. The most commonly grown varieties are the "touzelle" of Oran and bearded wheat imported from Algeria.

On December 1, 1921, the price per quintal varied, according to locality, between 50 and 70 fr. for soft wheat, and between 45 and 70 fr. for hard.

OATS. — The cultivation of oats is recent, and does not date further back than the beginning of the Protectorate. The varieties grown are Algerian, especially the yellow and black kinds.

*Areas cultivated under oats (hectares).*

	1915	1916	1917	1918	1919	1920	1921
By Europeans . . . . .	—	—	2458	3460	3609	2959	3338
By Natives . . . . .	—	—	365	793	660	399	431
<i>Totals . . . . .</i>	<b>1609</b>	<b>1752</b>	<b>2823</b>	<b>4253</b>	<b>4269</b>	<b>3358</b>	<b>3769</b>

Oats are used for cattle by Europeans and by the army of occupation.

RYE. — The area of cultivation is fairly limited in a few mountainous regions, though experiments made by the Directorate of Agriculture show that it could be grown anywhere, even on the light, sandy soils of the coast, and a yield of 14-15 qx. of grain per ha. in addition to straw obtained. If sown early it would be possible to cut it green during the winter and to get a fairly good crop of grain in May-June.

CANARY-GRASS (*Phalaris canariensis*). — Cultivation is limited and it is sown at the beginning of winter and harvested in June. The seed is used for feeding birds; an oil, used for dressing cotton cloth, and very commonly used in England, can also be extracted from it.

On December 1, 1921 the price of the seed varied between 50 fr. per quintal at Fez and 125 fr. at Rabat.

F. C

39 - **On the Tillering of Wheat.** — GAREKKE, W. F. (Laboratory of Soil Chemistry and Bacteriology, University of California), in *American Journal of Botany*, Vol. IX, No. 7, pp. 366-369. Brooklyn, July 1922.

The writer had previously remarked that nitrogen, supplied to wheat different times, had different effects; at an early stage it had little effect; at a later stage it caused an increase in the nitrogenous reserves of the grain and the whole of the dry matter in the plant. These experiments were made with a soil poor in nitrogen.

In the paper reviewed, the writer investigated the process by the help of which nitrogen induces tillering. He supposed that it acted by favouring the growth of the roots. In order to verify that supposition, he grew wheat plants, from 8 to 10 cm. high, with roots 10 to 12 cm. long, for 25 days in drinking water: the roots grew to a length of from 10 to 70 cm., while the stems scarcely grew more than 1 or 2 cm.; he then moved the plants, together with the control plants, and placed them in complete nutritive solutions; the weight of the aerial part was approximately equal in the two series, while the weight of the roots was respectively about  $\frac{1}{2}$  and  $\frac{1}{4}$  of the total weight and the roots in the first series were 4 times as long. The control plants tillered very slightly, generally a single stem per plant; on the other hand the young plants with large root development tillered in a remarkable manner; the averages were, respectively, 1.2 and 5.4 per plant, a proportion of 1: 4.5.

A large root development, therefore, is very favourable to tillering. In a soil poor in nitrogen, the roots develop very much because they seek the nutritive elements; if a large amount of nitrogen is put into the soil, the roots absorb it and vegetative growth is stimulated in them: there is consequently much tillering; on the other hand if nitrogen is given during the early stage of growth, the roots do not develop much and the growth cannot be stimulated later.

These data may be important for the cultural economy of wheat.

L. V.

90 - **Cultivation of Barley in England.** — RUSSELL E. J., in *Journal of the Institute of Brewing*, Vol. XXVIII, No. 9, pp. 697-713. London, September 1922.

1290.

The cultivation of barley is very ancient and goes back to theolithic period; it is also one of the most general crops in the world, as it extends from the Arctic Circle to the Equator.

The decrease which the cultivation of barley in England has suffered less than that of wheat and England is nearer freedom from importing barley than wheat as may be seen from Table I, in which the figures indicate millions of tons.

England has about 800 000 ha. under wheat and 600 000 under barley; Scotland and Ireland each have 24 000 ha. under wheat and 80 000 under barley.

Wheat and barley grow better in dry climates. In England the distribution of barley and wheat crops is approximately inverse to the rain-

[1289-1290]



TABLE I. — *Production and consumption of barley and wheat in England, from 1887 to 1920.*

Period	Wheat		Barley	
	Consumption	Production	Consumption	Production
1887-1891 . . . . .	6.1	2.02	2.56	1.69
1910-1914 . . . . .	6.8	1.60	2.40	1.38
1910-1920 . . . . .	7.4	1.34	1.91	1.32

fall. Barley is specially important in the county of Norfolk where it covers 15 % of the cultivated area, next in Suffolk, Lincolnshire, Rutland, Cambridgeshire and in East Yorkshire, where it occupies 9 to 12 % of the area under crops.

Sunshine probably affects wheat and barley more than absence of rain. Barley differs from wheat in other respects. Barley prefers light soils, wheat heavy soils. In England, barley is sown in spring and wheat in autumn. At Rothamsted, the period of growth for barley is 150 days (from April 1 to August 1), that of wheat 290 days (from the end of October to the middle of August. It is probable that the smaller production of straw and grain by barley compared with wheat, depends on this shorter period. Barley places, in comparison with wheat, a greater proportion of its substance in the grain than in the straw.

TABLE II. — *Distribution of the matter and nitrogen in the straw and grain in barley and wheat.*

*Average of harvests (1910-1919) in England.*

	Dry matter in kg. per ha.		Nitrogen in kg. per ha.	
	Straw	Grain	Straw	Grain
Barley . . . . .	3 500	2 500	19	45
Wheat . . . . .	4 800	2 200	25	47

Experiments made at Rothamsted from 1852 to 1855 with chemical manures enabled the yield of barley to be increased from 30 to more than 50 bushels per acre.

This was a remarkable result for the period and had a great influence on the development of the Chemical manure industry, which commenced at Rothamsted in a barn, in 1843, and has since attained such huge proportions. The continuation of experiments started at Rothamsted has enabled certain questions to be elucidated, but others still remain obscure. One of the most singular phenomena is the constant decrease of crops, which

TABLE III. — *Comparative effect of various manures on the grain yield of barley (bushels per acre).*

Without manure . . . . .	29.8
Farmyard manure . . . . .	44
Complete artificial fertilisers :	
With nitrate of soda . . . . .	50.5
sulphate of ammonia . . . . .	47

pecially noticeable on plots treated with chemical manures and slightly so on those treated with farmyard manure. Table IV shows the number of times that certain yields have been recorded, by decennial periods, the plots treated with artificial manures. As is seen, good crops go decreasing and bad crops increasing.

It is difficult to explain this phenomenon. It has been attributed to unfavourable changes in climate or to a supposed secretion of poison by the plant, but nothing has been proved. It has been thought that the commonly accepted list of elements indispensable to nutrition was incomplete: BERTRAND has shown the utility of manganese; MAZÉ has added to the list boron, fluorine, chlorine, aluminium and zinc. BRENCHEY at Rothamsted, confirmed the utility of manganese and of boron in small quantities; in large quantities it became injurious. It might therefore be supposed that the lack of these elements in ordinary artificial manures might slowly exhaust the reserves in the soil while there would be a certain amount of them in farmyard manure, but objections are raised against this opinion.

TABLE IV. — *Frequency of certain yields of barley from 1852 to 1921.*

Periods	Bushels per acre					
	60-70	50-60	40-50	30-40	20-30	10-20
52-1861 . . . . .	1	3	3	3	—	—
62-1871 . . . . .	—	2	6	2	—	—
72-1881 . . . . .	—	2	3	4	1	—
82-1891 . . . . .	—	2	4	3	1	—
92-1901 . . . . .	—	1	4	2	3	—
02-1911 . . . . .	—	1	3	5	1	—
12-1921 . . . . .	—	—	1	5	1	1

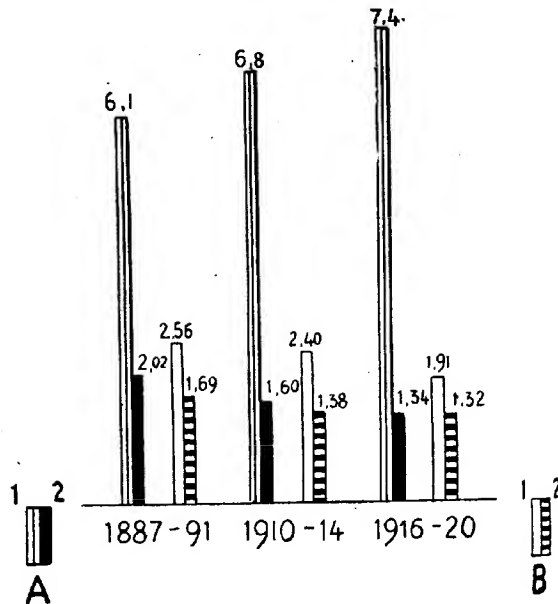
It might also be thought that the addition of an electrolyte disturbs the colloidal properties of the soil. At Rothamsted the problem is submitted to systematic research.

Fortunately this phenomenon does not occur in the general English crop; the average crop in that country has even increased slightly:-

1887-1896	33.16 bushels per acre
1897-1906	33.64 " " "
1907-1916	33.67 " " "

The heaviest crop recorded by the writer was 80 bushels per acre. Two factors prevent barley from reaching that figure:- the season

FIG. 1. — *Production and consumption of wheat and barley in England, in millions of tons per annum.*



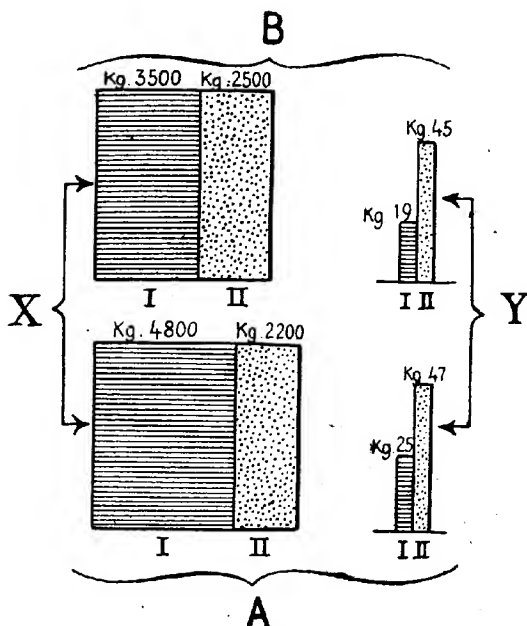
EXPLANATION :

A = wheat; 1 = consumption; 2 = production  
B = barley; 1 = consumption; 2 = production.

and the strength of the straw, which is often incapable of supporting a large weight of grain.

The problem of the strength of the straw is one of the most serious and urgent problems; it is partly physiological and partly genetic, and we have scarcely anything but a little empiric knowledge of it. It depends on chemical changes, mechanical arrangements of the tissues or the osmotic pressure of the cell sap.

So long as we have not been successful in producing varieties of barley with much stronger straw there is no use in stimulating the development of the grain to the utmost by means of artificial manures. There are, besides, other factors which restrict the growth of barley:—insufficient rainfall, temperature, incapacity of the plant to utilise the whole of the available energy. From an industrial standpoint, quality is still more im-



EXPLANATION :

A = wheat ; B = barley ; X = dry matter in kg. per ha ; Y = nitrogen in kg. per ha. ; I = straw ; II = grain.

tant than quantity. The percentage of nitrogen is not much affected by manures. By potash and phosphate manuring the carbo-hydrate content is easily increased without increasing the nitrogen content. On the other hand, the latter is very much affected by climatic conditions. Generally nitrogen content is inversely proportional to the yield in grain.

The Rothamsted experiments have proved the falseness of the opinion according to which, during maturation, plants supply the grain first with nitrogen and afterwards with carbo-hydrates.

Very little has been added to the classic works of MUNRO and BEAVER

on the aptitude of barley for brewing. The nitrogen content may be used as an indication of that aptitude, as it is more or less inversely proportional to it. In this there is no really causal relation: a good quality barley has a large proportion of endosperm as compared with embryo; this happens when climatic conditions have been good during the second part of the life of the plant, and generally implies a low nitrogen content, because the nitrogen is absorbed, for the greater part, at the commencement of growth.

The British Institute of Brewing has just undertaken very extensive research on the relation of good quality of barley and its agricultural conditions and it is hoped that they will throw much light on this important question. Five series of plots have been prepared:— 1) without manure; 2) complete artificial manures; 3) artificial manures containing no potash; 4) artificial manures containing no phosphate; 5) artificial manures containing no nitrogen. Complete analyses of samples of the barley grown will then be made.

Another problem, more difficult to solve, is at present under examination: it concerns the influence of the soil and season on the quality of the barley. Lastly, the Institute has just come to another serious question: the chemical composition of a good quality barley. But the final solution of this problem requires biochemical knowledge not yet possessed.

The Institute has the great merit of having set up co-operation between brewers, barley growers, agricultural experts and chemists. Such co-operation is no doubt destined to give the best results. A. de B.

1291 — **Rice Planting in Sarawak.** — *Journal of the Royal Society of Arts*, Vol. LXX, No. 3644, pp. 766-767. London, September 22, 1922.

Of the many different tribes inhabiting Sarawak all cultivate rice with the exception of the nomadic tribes of the far interior. The methods adopted vary slightly but are for the most part of a primitive order. The inland tribes mostly cultivate "hill" rice, and for this purpose clear and destroy large quantities of valuable timber every year by cutting and burning. "Hill" land that has been farmed is allowed to lie fallow for at least seven years and "wet" land for three years.

The planting is done at the end of the dry season, about July and August, so that the growing crops may have the benefit of the rains and the grain have a chance of ripening in the beginning of the next fine season, about April or May. If old jungle is cleared the clearing is commenced about May or June in order that the timber may have time to dry before the burning time.

Buffaloes are not used for preparing the ground except by the tribes living in the districts adjacent to Brunei and also by the tribes inhabiting the highlands at the head waters of the Baram, Limbang and Trusan rivers.

**SOWING.** — The seed of the hill padi is planted in holes about 1" to 18" apart made by a blunt pointed stick. Three or four seeds are dropped

to each hole and covered by scraping earth or ashes over the hole with the foot.

Marsh padi is either broadcasted or transplanted. If old jungle has been cleared the seed is usually broadcasted, but otherwise it is transplanted from nurseries when about 6" high into holes drilled with a pointed stick.

The farms are strongly fenced to keep out the wild pig and deer immediately after the padi commences to grow.

The weeding is usually left to the women and children whilst the men are hunting or in search of jungle produce.

**CATCH CROPS.** — Immediately after the burning, tobacco, maize, cucumbers, bayam, egg plants, etc. are planted wherever the wood ashes are thickest. These ripen and are eaten before the harvest. Millet is also planted on the edges of the paths and at the edges of the farm. This is done partly to keep the monkeys occupied till the owner arrives and drives them away.

**THE HARVEST.** — The heads of the padi seldom ripen all together; consequently the crop is not reaped all at once, but the ripe heads are collected. The Dayaks do not use knives but strip the ripe heads with their fingers.

The padi is stored sometimes in the houses in receptacles made of the bark of large trees and sometimes in specially constructed granaries. When it is desired to convert the padi into rice it is pounded in mortars or put through a husker and then winnowed.

Crops vary greatly in quantity, the following being the usual causes of failure: an unsuccessful burning of the clearing, insufficient rain at the planting season, insufficient sunlight during the ripening period, depredations of wild animals, rats and mice, attacks of insects, etc.

The use of large quantities of rice in the making of spirituous drinks amongst the non-Mohammedan tribes, «tabus» observance and feasts result not infrequently in a shortage of rice.

In the absence of reliable statistics it is impossible to estimate the average yield, but a fair average for hill padi would probably be about 30 fold and for swamp padi about 70 to 100 fold.

G. A. B.

292 — **Food Pulse Crops in Morocco.** — *Annales de l'Institut Colonial de Bordeaux*, pp. 139-144. Paris-Bordeaux, May 1922.

**BEANS.** — These are of good quality; the Safi variety, with small seeds and richer in gluten, have a higher value than the large beans of Casablanca and Magazen.

The areas under beans from 1915 to 1921 were as follows:—

Year	Ares
1915 . . . . .	28 576
1916 . . . . .	38 097
1917 . . . . .	39 176
1918 . . . . .	64 850
1919 . . . . .	68 315
1920 . . . . .	66 536
1921 . . . . .	59 638

[1291-1292]

Beans are sown in rows, at the beginning of the autumn rains; the green pods are gathered in April and the dry seed in May.

Experiments made in 1916-1917 with the Seville bean, an early variety with fairly long pods, yielded 14.7 qx. per ha.; those of 1917-1918, 21 qx. per ha. The large broad-bean, in spite of adverse circumstances, yielded 12 qx. per ha. Several diseases of vegetable and animal origin may injure the crop: the average yield per ha. in 1921 for the whole of Morocco was 8.2 qx. Part of the yield is eaten by the natives, but the greater part is exported.

*Export of beans from ports in the French zone of Morocco, during 1921.*

January . . . . .	1 942 267 kg
February . . . . .	368 918 "
March . . . . .	294 195 "
April . . . . .	248 094 "
May . . . . .	652 454 "
June . . . . .	10 206 539 "
July . . . . .	14 582 346 "
August . . . . .	8 881 265 "
September . . . . .	16 285 414 "
October . . . . .	2 624 483 "
November . . . . .	2 962 310 "

CHICK-PEAS. — These are grown in the southern regions; they are sown in deep soils because of their large deep root system and grow fairly well in dry climates; the areas sown during the past few years have varied as follows:—

1915 . . . . .	16 305 ha
1916 . . . . .	21 236 "
1917 . . . . .	22 525 "
1918 . . . . .	32 150 "
1919 . . . . .	29 870 "
1920 . . . . .	27 341 "
1921 . . . . .	32 277 "

In 1921, the average yield was 7 qx. per ha. The chick-peas are passed through a sieve and classed in three divisions bearing the numbers 27 — 28 — 29, the higher number indicating better quality.

*Exports of chick-peas from Morocco from 1915 to 1921.*

Years	Quintals	Francs
1915 . . . . .	61 994	1 859 829
1916 . . . . .	52 326	1 865 860
1917 . . . . .	58 650	3 662 931
1918 . . . . .	40 964	2 250 481
1919 . . . . .	176 920	14 666 678
1920 . . . . .	63 970	8 234 021
1921 (up to November) . . . . .	169 263	—

**LENTILS.** — The native varieties are small but very fine and very suitable as food for Europeans. The development of their cultivation from 1915 onwards is shown by the following figures. —

1915 . . . . .	35 ha.
1916 . . . . .	739 »
1917 . . . . .	941 »
1918 . . . . .	2 453 »
1919 . . . . .	7 692 »
1920 . . . . .	5 993 »
1921 . . . . .	5 216 »

Clay soils cannot be used for growing lentils ; they are gathered in July and in 1918, the average yield was 9 qx. per ha. at Marrakesch, and in 1920, 6 qx. at Fez, although the gathering was done under unfavourable conditions.

*Exports of lentils from Morocco, from 1915 to 1921.*

Years	Quintals	Francs
1915 . . . . .	1	25
1916 . . . . .	1 019	49 058
1917 . . . . .	1 265	78 617
1918 . . . . .	5 838	516 027
1919 . . . . .	38 452	3 667 945
1920 . . . . .	42 842	4 583 460
1921 (up to November) . . . . .	42 512	—

The prices varied between 35 and 100 fr. per quintal.

**FENUGREEK** (*Trigonella*). — The seeds of this leguminous plant are used by Orientals as a condiment ; they are also used for fattening animals but they give the meat a disagreeable taste ; they form an ingredient in oultices. Sowing is done in autumn on low moist ground, 20 kg. of seed being used per ha. ; the crop is gathered in June-July and in 1921, the average yield was 2 qx. of seed per ha.

*Exports of fenugreek seed from Morocco, from 1915 to 1920.*

Years	Kilogrammes	Francs
1915 . . . . .	3 459 604	61 113
1916 . . . . .	1 359 554	428 401
1917 . . . . .	1 952 718	2 290 332
1918 . . . . .	5 651 920	4 374 450
1919 . . . . .	3 664 399	1 695 878
1920 . . . . .	11 205 262	5 079 232

On December 1, 1921 the price of fenugreek seed varied between 35 and 44 fr. per quintal.

F. C.

[1992]



1293—**Effect of different Reactions on the Growth of Soy Beans and the Formation of Nodules.** — BRYAN, O. C. (Wisconsin Agricultural Experiment Station), in *Soil Science* Vol. XIII, No. 4, pp. 271-302, 15 pl., bibliography of 39 publications. Baltimore Apl. 1922.

The reaction with which leguminous plants grow and are best inoculated has yet to be ascertained. The writer made a series of experiments in order to solve the question in the case of the soy bean, of which he prepared many cultures in saline solution and in sand, in vessels of 500 to 600 cubic cm. capacity. The reaction of the solutions was regulated by adding alkalis or acids and maintained constant by changing the solutions daily. The plants were allowed to grow for 25 to 35 days after inoculation. Other cultures of maize and cowpeas were made under similar conditions to those of soy beans, for comparison. Moreover 21 cultures of the same number of species of soy bean bacteria were prepared so as to be able, after 15 or 20 day's incubation, to compare the critical concentration of the hydrogen ions for soy bean bacteria and for the plants which harboured them.

SHRIVE's nutritive solution proved favourable to the growth and inoculation of soy beans in the sand cultures, but not in the aqueous cultures. Perhaps there may have been poisonous impurities in the salts of the solution which were absorbed by the sand. CRONE's solution proved suitable for all the cultures; its "cushion effect", that is to say its aptitude for resisting changes of pH, was improved by the addition of 0.75 gm. of carbonate of soda per litre.

The reaction of the solution in contact with the plant does not remain constant except in the case of the reaction most favourable to its growth. Changes take place more rapidly in alkaline solutions and with plants which grow quickly. The reaction most favourable to growth and inoculation of soy beans was pH = 6.5. The limits of pH between which inoculation took place were 4.6 and 8. The limits for the growth of soy beans were 3.9 and 9.6. Reactions in which pH = 4.95 and 8.2 are injurious to the growth of soy beans, but do not completely prevent inoculation.

The values of pH which proved decidedly injurious were not generally greater, but often very much less than values given by soils considered to be very acid.

The critical concentration of hydrogen ions for the formation of nodules on soy beans was slightly less than that for its growth. The different cultures of bacteria showed a slight difference as regards the critical value of pH.

Maize grows within much wider limits than soy beans and cowpeas. The cowpeas seem to have wider limits than soybeans regarding the formation of nodules. The reaction of the vegetable sap was, generally, equal to that of the nutritive solution, except for the leaves of maize which showed a certain difference. The sap of the roots followed the reaction of the medium more closely than that of the leaves.

A. de B.

294 - **Good Forage Grasses of Southern Rhodesia.** — MUNDY, H. G. (Chief Agriculturist and Botanist), in *Department of Agriculture, Salisbury, Rhodesia, Bulletin* No. 417, 17 pp., 8 full page tabl. Salisbury, 1922.

Since 1911 the Department of Agriculture in Rhodesia has carried out experiments with good forage plants suitable for cultivation in that country, that is to say already acclimatised or capable of acclimatisation, which stand cold and drought and are eaten by cattle and are nutritious. After a few years it was noticed that as a rule, the most highly recommended exotic forage plants did not thrive under the new con-

*Percentage composition of various forage grasses growing in Rhodesia.*

Species	Moisture	Fat (ether extract)	Crude protein	Non nitrogenous extracts	Crude cellulose	Ash	Pure protein	Total nitrogen	Protein nitrogen	Actual protein per 1000 kg. of dry matter
	%	%	%	%	%	%	%	%	%	kg.
<b>BEFORE FLOWERING :</b>										
<i>Setaria Lindenberghiana</i> . . . .	10.66	3.48	16.38	33.69	24.10	11.69	14.06	2.62	2.25	157
<i>Phalaris bulbosa</i> . . . . .	10.51	2.91	15.62	40.45	21.30	9.21	11.56	2.50	1.85	129
<i>Pennisetum clandestinum</i> . . . .	8.40	2.38	12.12	41.91	25.42	9.77	10.31	1.94	1.65	112.5
<i>Penhalonga</i> grass . . . . .	11.28	2.45	11.81	39.74	25.95	8.77	9.06	1.89	1.45	102
<i>Brachiaria brizantha</i> . . . . .	9.99	2.17	12.69	40.74	21.96	12.45	8.75	2.03	1.40	97
<i>Bembanthia fasciculata</i> . . . .	8.47	1.72	7.31	46.27	29.77	6.46	6.88	1.17	1.10	75
<b>WHEN FLOWERING :</b>										
<i>Anticum maximum</i> . . . . .	10.04	1.61	10.94	36.04	32.60	8.77	10.00	1.75	1.60	121
<i>Setaria sulcata</i> . . . . .	9.81	1.91	13.31	37.80	27.38	9.79	10.00	2.13	1.60	111
<i>Setaria aurea</i> . . . . .	8.30	2.62	14.12	36.74	26.73	11.49	10.00	2.26	1.60	109
<i>Brachiaria brizantha</i> . . . . .	9.48	1.95	10.25	35.79	33.07	9.46	9.69	1.64	1.55	107
<i>Astachys petrea</i> . . . . .	11.25	2.98	10.25	39.46	28.25	7.81	9.06	1.64	1.45	102
<i>Chinoclao pyramidalis</i> . . . .	9.22	1.83	11.37	36.24	32.86	8.48	9.06	1.82	1.45	99.5
<i>Gynodon plectostachyum</i> . . . .	9.79	1.60	8.62	48.07	26.52	5.40	5.62	1.38	0.90	62.5
<b>PLANTS WITH FLOWERS AND SEEDS :</b>										
<i>Aspalum virgatum</i> . . . . .	9.19	2.64	9.06	39.32	32.70	7.09	8.44	1.45	1.35	91.5
<i>Aspalum scrobiculatum</i> . . . .	11.22	2.25	8.62	46.64	23.90	7.27	8.13	1.38	1.30	91.5
<i>Gynodon plectostachyum</i> . . . .	8.58	1.63	9.06	46.47	28.17	6.09	7.81	1.45	1.25	85.5
<b>HAY :</b>										
<i>Aspalum scrobiculatum</i> . . . .	10.38	1.95	7.00	45.88	27.13	7.66	6.88	1.12	1.10	76.5
<i>Pennisetum unisetum</i> . . . . .	7.82	1.49	7.31	40.16	34.20	9.02	6.56	1.17	1.05	71
<i>Brachiaria brizantha</i> . . . . .	10.29	2.33	8.44	41.44	26.75	10.75	6.25	1.35	1.00	69.5
<i>Bloris Gayana</i> . . . . .	8.43	2.07	8.50	38.47	33.09	9.44	5.94	1.36	0.95	65
<i>Setaria aurea</i> . . . . .	8.57	1.91	6.25	36.83	36.62	10.22	5.31	1.00	0.85	58
<i>Nicholaena rosea</i> . . . . .	7.58	1.59	5.69	41.52	36.82	6.80	5.31	0.91	0.85	57.5
<i>Aspalum virgatum</i> . . . . .	8.90	2.20	4.69	42.60	34.97	6.64	4.38	0.75	0.70	48
<i>Nicholaena setifolia</i> . . . . .	8.93	2.31	5.81	40.31	34.85	7.79	4.06	0.93	0.65	44.5

ditions of their environment or else lost their qualities, while good results could be obtained by systematic selection of indigenous forage plants.

At present the following are being tested at Salisbury:— 55 indigenous species or subspecies — 10 African, but not Rhodesian, species. From their behaviour on dioritic red soils of medium texture, in Mashonaland, it is recommended to make meadows with the following species, the botanical description and cultural characteristics of which are given:—

INDIGENOUS TO RHODESIA. — "Rhodesian tussock grass" (*Setaria Lindenberghiana*) — "Pehalonga grass" — "False paspalum" (*Brachiaria brizantha*) — "Swamp couch grass" (*Hemathria fasciculata*) — "Fine Guinea grass" (*Panicum maximum*) — "Buffalo grass" (*Setaria sulcata*) — "Golden timothy grass" (*Setaria aurea*) — "Red Rhodes grass" (*Eustachys petrea*) — "Antelope grass" (*Echinochloa pyramidalis*) — "Tall couch grass" (*Cynodon Dactylon*) — "Native paspalum" (*Paspalum scrobiculatum*) — "Common red top grass" (*Tricholaena rosea*) — "Bristle leaved red top" (*Tricholaena setifolia*).  
EXOTICS. — "Kikugu" (*Pennisetum clandestinum*) — "Natal grass" (*P. unisetum*) — "African Star grass" (*Cynodon plectostachyum*) — "Perennial canary grass" (*Phalaris bulbosa*) — "Upright paspalum" (*Paspalum virgatum*) — "Rhodes grass" (*Eustachys Gayana*):

The composition of these grasses (air dried samples) and of the hay obtained by cutting them at the moment when they flowered is given in the Table at page 1487. F. D.

1295 — Species of *Rumex* in Grass-lands. — ROGER, R., in *Journal d'Agriculture française*, 86th Year, Vol. II, No. 32, pp. 131-134, 1 fig. Paris, Aug. 12, 1922.

In the grass-lands of the East of France, and probably also in those of other regions, an exceptionally abundant invasion of large species of *Rumex* (*R. nemorosus*, *R. conglomerata*, *R. palustris*, etc.) occurred during 1922, thus adding to the depreciation caused by wild sorrel (*R. acetosa*) in the food value of the forage and threatening, unless energetic control measures are taken, to render in a few years the produce of the infested grass-lands quite unusable, except as inferior litter. All large species of *Rumex* are as a matter of fact rejected by cattle, both in a green state and when mixed in dry fodder, and their presence in a grass field will always be a cause of depreciation in the value of the produce.

On the other hand these plants are perennial and exceedingly prolific, so that it is difficult to keep them out.

The cause of the invasion appears to be as follows. The drought of 1921, paralysing the growth of forage plants, caused many farmers to give up to grazing a certain number of meadows usually kept for mowing and, as the cattle left the *Rumex* alone, these undesirable plants remained, withstood the drought owing to their deep taproots, and were able to grow quite freely, to fructify and to ripen their innumerable seeds. The seeds being light and winged, as a result of the persistence of the developed floral envelopes, were scattered by the wind over a large area all round the mother plant.

In certain cases, floods have assisted the wind and carried the injurious seeds to great distances and grass-lands previously free from the weed have become infested. In 1922 as the hay season approached the farmers were greatly and disagreeably surprised when they saw the tall rust coloured ramets of the invaders. The more prudent anticipated the usual time of mowing, so as to prevent the plants from ripening their seed and extending their ravages further by self propagation. This was however exceptional and most of the infested meadows were cut at the ordinary time.

Early mowing, which generally suffices to get rid of annual species which are undesirable in a meadow, seems the only efficient remedy. Unfortunately in this case it only served to prevent the invasion from spreading by stopping the multiplication of the large species of *Rumex*, which are almost all perennial. Moreover this quality of persistence resists the use of liquid weed-killers.

To eliminate these obstructive and injurious weeds it was found necessary to destroy them plant by plant either by pulling them up or by cutting the roots, in two places. The best time for uprooting appears to be at the end of May or early in June, when the plant owing to its height is easily seen above the grass. If the operation is done after rainy weather, when the moist earth holds the roots less firmly, a good pull on the stalk is sufficient to uproot the plant; if this is not the case a well applied stroke of a spade will sever the root and enable the plant with the part of the root above the point of section to be removed.

However carefully the work is done a certain number of plants may escape destruction and threaten, by seeding, to reduce the effect. Cutting down at a suitable time will prevent seed ripening and seed propagation, and, if care is taken in the following year to root up the plants previously overlooked, in the end the field will be freed. But it will always remain subject to fresh invasion for no meadow is safe.

While the fiddle dock (*R. pulcher*) and the curled dock (*R. crispus*) grow mainly in well drained and even dry meadows, the wood dock (*R. nemorosus*) and the broad dock (*R. obtusifolius*) establish themselves indiscriminately on all kinds of ground and they all readily take their chance on moist bottoms, such as are preferred by the marsh dock (*R. palustris*) and the water dock (*R. hydrolapathum*). It would be wise to watch all meadows carefully so as to deal with the weed as soon as it appears. Such watchfulness will be all the more desirable if the meadow is close to uncultivated land where weeds grow and multiply freely. In such cases it would be a good preventive measure to cut the *Rumex* plants growing on such land before their seed ripens.

L. V.

26 - Effect of Crude Phosphates and Basic Slags on the Quality of Hay and Pastures. — ROBERTSON, G. S., in *The Journal of the Ministry of Agriculture*, Vol. XXIX, No. 3, p. 600-605, 1 fig. London, Oct. 1922.

The most important indirect effect caused by the application of basic slugs to pastures, is the great improvement in the quality and nutritive value of the forage. A certain quantity of hay obtained from land treated

with slags has a much greater nutritive value than the same quantity of hay obtained from untreated land. The Cockle Park experiments have caused this increase to be valued at 13 shillings a ton, on a basis of pre-war prices.

TABLE I. — *Botanical composition of the hay.*

	Plot I Open earth slag (fluoritic)	Plot II Open Hearth slag (very soluble)	Plot III Without manure	Plot IV Gafsa mineral phosphate	Plot V Egyptian mineral phosphate	Plot VI Algerian mineral phosphate
	%	%	%	%	%	%
Leguminous plants . . . . .	traces	traces	traces	traces	traces	traces
Grasses . . . . .	85.2	88.1	58.5	82.6	96.7	95.8
Weeds . . . . .	14.8	11.9	41.5	17.4	3.3	4.2

TABLE II. — *Composition of the grasses by weight.*

	Plot I Open Hearth slag (fluoritic)	Plot II Open Hearth slag (very soluble)	Plot III Without manure	Plot IV Gafsa mineral phosphate	Plot V Egyptian mineral phosphate	Plot VI Algerian mineral phosphate
	%	%	%	%	%	%
<i>Lolium perenne</i> . . . . .	9.9	22.0	6.8	26.9	19.8	17.0
<i>Phleum pratense</i> . . . . .	6.0	7.7	2.8	4.5	5.7	1.9
<i>Cynosurus cristatus</i> . . . . .	20.6	14.7	10.8	25.2	28.7	10.6
<i>Poa trivialis</i> . . . . .	1.3	12.0	0.6	10.9	7.3	9.5
<i>Avena flavescens</i> . . . . .	1.3	1.4	0.6	1.0	1.3	0.6
<i>Festuca ovina</i> . . . . .	—	0.9	—	—	—	—
<i>Holcus lanatus</i> . . . . .	32.5	29.7	44.3	18.0	17.0	29.0
<i>Agrostis alba</i> . . . . .	0.7	2.6	6.8	4.5	4.8	11.2
<i>Anthoxanthum odoratum</i> . . . . .	27.7	9.0	27.3	9.0	15.4	20.2
	100.0	100.0	100.0	100.0	100.0	100.0
Tall grasses . . . . .	39.1	58.7	21.6	68.45	62.8	39.6
Short grasses . . . . .	60.9	41.3	78.4	31.55	37.2	60.4

It is therefore very important to know whether the new types of basal slags and other substitutes have a corresponding influence on the crop. In experiments made at Martins Heerne, in 1917 and 1918, clover made great growth on manured plots and especially on those to which were

lied the very soluble slag and the mineral phosphates, particularly the mineral phosphate. In the dry season of 1919, clover did not grow either on the manured plots or on the others; however, the former were always distinguished by bright colour and a double crop of hay.

The Gafsa and Egyptian mineral phosphates have similar efficiency to that of very soluble basic slags, while the efficiency of fluoritic slag is much less and that of Algerian phosphate is the least of all. In 1920, leguminous plants again grew well and equally so on the plot manured with very soluble slag and on that manured with phosphate.

TABLE III. — *Composition of hay in 1920.*

	Plot II (very soluble basic slag)	Plot III (without manure)	Plot IV (Gafsa mineral phosphate)
	%	%	%
leguminous plants . . . . .	27.5	11.2	35.0
grasses . . . . .	63.0	53.5	54.2
weeds . . . . .	9.5	30.3	10.8

Other experiments made at Horndon, by manuring in February 1918 and by analysing the soils in August 1919, gave the results shown in Table IV.

TABLE IV. — *Percentages of space occupied by vegetation in the Horndon plots.*

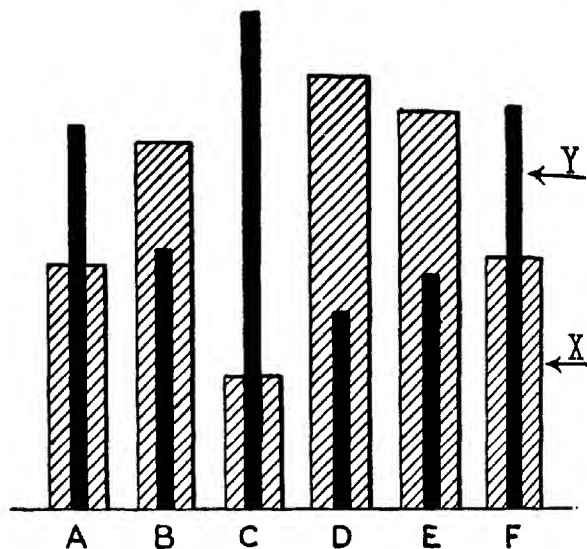
Manure (220 kg. of phosphoric acid per ha)	Legumi- nous plants	Grasses	Weeds	Basic space
	%	%	%	%
Lime only . . . . .	15.1	34.6	30.0	20.3
Florida "pebble" phosphate . . . . .	46.0	30.6	13.3	10.1
Algerian phosphate . . . . .	47.4	30.1	7.4	15.1
Very soluble Open Hearth slag . . . . .	44.1	28.6	13.7	13.6
Without manure . . . . .	4.2	14.8	31.0	50.0
Gafsa phosphate . . . . .	41.3	32.3	17.6	8.8
Tunisian phosphate . . . . .	38.5	36.9	21.0	3.6
Egyptian phosphate . . . . .	55.5	41.10	10.7	2.8
Superphosphate (220 kg. of $P_2O_5$ per ha.) . . . . .	23.9	57.3	0.7	18.1
Superphosphate (55 kg. of $P_2O_5$ per ha.) . . . . .	18.8	25.3	18.8	37.1
Superphosphate (as in 13) + 2.5 <sup>l</sup> of lime per ha. . . . .	60.0	32.7	1.4	5.9
Without manure . . . . .	9.4	19.1	26.0	45.5
Very soluble Open Hearth slag (as in 5) . . . . .	46.2	47.2	1.4	5.2
Open Hearth fluoritic slag . . . . .	43.8	31.8	13.3	11.1
Cleveland phosphate . . . . .	43.1	33.3	5.6	18.0

These results and those obtained the following year with hay anal the 4 following important conclusions to be drawn :—

1) Various basic phosphates (mineral phosphates, very soluble or slightly soluble slags, basic superphosphates) produce the same kind of improvement and to an equal extent.

2) By comparing the above results with those obtained the following year with hay, it is noticed that there is no close relation

*Influence of phosphate manures on the composition of the hay.*



EXPLANATION :

Y = weights of tall grasses ; X = weights of short grasses.

A = manuring with slightly soluble basic slags ; B = manuring with very soluble slags ; C = control ; D = Gafsa crude phosphate ; E = Egyptian crude phosphate ; F = Algerian crude phosphate.

tween the two and the former results do not enable the latter to be estimated. For example, of plots 17 and 18, which were almost equal regards quality of pasture, plot 17 yielded about twice as much hay as plot 18 in the following year.

3) In soils poor in lime, superphosphate has an unsatisfactory effect especially on leguminous plants, while it acts better on grasses. If mixed with lime, thus forming "basic superphosphate", it is even more satisfactory to leguminous plants than basic phosphates.

4) Lime alone is of no use on such soils.

A. de B.

7 - **Fibre Crops in Morocco.** — *Annales de l'Institut Colonial de Bordeaux*, pp. 207-211. Paris-Bordeaux, July-Aug. 1922.

**FLAX.** — The growth of flax for linseed has been in vogue for a very long time in Morocco, especially in the districts of Chaouia and the Doukkas, but is capable of extension in other districts. Flax grows well on deep siliceous-clay soils and a previous crop of beans or chick-peas is very favourable to it. Sowing takes place in October, although many farmers persist in sowing in February. Table I gives the experimental results collected by the Director of Agriculture regarding the yield of linseed per hectare in relation to the time of sowing.

TABLE I. — *Yield of linseed in relation to time of sowing.*

Variety	Date of sowing	Yield per ha. quintals
genous flax . . . . .	29 January	39.25
thern flax . . . . .	30 " "	35.85
mandy flax . . . . .	26 February	40.75
thern flax . . . . .	27 " "	37.05
a flax . . . . .	3 March	51.76
mandy flax . . . . .	25 February	23.50

In 1921 the average yield of linseed per hectare for the whole of Morocco was 6 %.

TABLE II. — *Areas under flax from 1915 to 1921.*

1915 . . . . .	4 867 ha.
1916 . . . . .	3 306 "
1917 . . . . .	5 251 "
1918 . . . . .	15 812 "
1919 . . . . .	28 955 "
1920 . . . . .	39 910 "
1921 . . . . .	17 870 "

In consequence of the suppression of the export of Russian flax, means were sought for utilising the stalks of Moroccan flax and satisfactory results were obtained. The exports of the products are shown in Table III.

On January, 1922 the value of linseed per quintal varied between 60 and 80 fr.

**HEMP.** — The growth of this crop, which was very restricted at the beginning of the war, increased during the war owing to high prices. Hemp grows well on deep, moist, light soils, and especially on alluvial soils. The farmers, who have grown hemp for a very long time, spread the manure with the greatest care and as a rule irrigate every 8 or 10 days.



TABLE III. — *Export of linseed and flax stalks from Morocco from 1915 to 1920*

Years	Kilogrammes	Francs
<i>Linseed.</i>		
1915 . . . . .	7,134,334	2,282.98
1916 . . . . .	2,076,706	1,221.94
1917 . . . . .	4,293,130	5,511.27
1918 . . . . .	3,877,844	4,155.37
1919 . . . . .	16,591,023	21,044.16
1920 . . . . .	17,921,773	24,944.22
<i>Flax stalks.</i>		
1915 . . . . .	13	1
1916 . . . . .	59,758	43.18
1917 . . . . .	207,251	318.62
1918 . . . . .	217,608	647.04
1919 . . . . .	483,384	1,447.83
1920 . . . . .	526,430	1,591.28

Statistical data are scarce and incomplete. On January 1, 1922, the prices varied between 60 and 80 fr. per quintal for hempseed and 450 l per quintal for tow.

F. C.

1298 — **Cotton in French Africa.** — I. *Annales de l'Institut Colonial de Bordeaux*, pp. 145-146 Paris-Bordeaux, May 1922. — II. MARION, A. G., *Ibidem*, June 1922.

I. — The production of cotton in the Ivory Coast, from 1913 to 1920, was as follows:—

1913 . . . . .	18 221 kg.
1914 . . . . .	73 435 "
1915 . . . . .	94 840 "
1916 . . . . .	357 597 "
1917 . . . . .	148 038 "
1918 . . . . .	434 091 "
1919 . . . . .	336 263 "
1920 . . . . .	207 999 "

But native-grown cotton is not ginned; it has therefore only a small market value, since it cannot be exported to Europe.

For this reason the Administration of the Colony, in agreement with the Cotton-growers Association has started establishments for ginning and baling cotton. The rainfall in the Ivory Coast Colony is however, excessive for cotton and in years when there are heavy early rains the fibre is spoiled before it ripens and is gathered. Considered as a secondary crop in association with native-grown yams and sweet potatoes it may have a certain

value for the people of the country. It is estimated that there might be an export of 1200-1500 tons of cotton in excess of the quantity utilized locally by the natives.

II. — In Central Logone, the growth of cotton is still in an elementary state because there are no means of transporting the produce from the Colony. The Central African Company has planted cotton fields on the banks of the Mayo-Kabi, at Léré, but the transport of the cotton to Europe is not easy, as the steamers of the Niger Company only get as far as Gambia when the river is in flood; when Gambia is connected by rail with Dakar this difficulty will be removed and it will be possible to introduce cotton into the whole of the Tchad region. The area between the Chari and the Logone, south of the extreme limit of the annual floods, is one of the most suitable districts for cotton growing: the soil there is light, in some places sandy clay rich in humus. Experiments made in 1920 gave good results though made late and with unselected seed. The cotton is of long silky staple, strong and is similar to that of Dahomey. Over 200 ha. have been planted, but it will be necessary to get over the apathy of the natives who will not have anything to do with crops other than their primitive cultivation of millet, sesame and groundnuts. Moreover the population is scanty owing to diseases.

To instruct the natives in agriculture, the writer has organised, near Zargaye, a school-farm to which each village will send one of their best men: the natives will there learn how to plough, the value of dung as manure, methods of growing cotton and picking it so as to avoid soiling the produce. Meanwhile the climatic and surrounding conditions will be studied, the most favourable times for sowing and picking will be ascertained, seed for distribution to villages will be selected so that when the Tchad district is connected with the coast by railway, this area will be able to supply cotton of a homogeneous type, suitable for the European markets.

F. C.

1. — The Technological Value of the New Hebrides Cottons. — HEIM, F., and ROERICH, O., in *Bulletin de l'Agence générale des Colonies*, Year XV, No. 160, pp. 1-14. Melun, January 1922.

A study of the characters of two samples of cotton from the New Hebrides that were forwarded for examination to the Laboratory of Colonial Products. Both samples belong to the South American variety *Gossypium peruvianum* Cav.; one was gathered in 1918, and the other in 1920.

The conclusions arrived at by the authors are as follows: New Hebrides cotton will never fetch the price of the best Egyptian varieties. Its tenacity, owing to the relative thickness of the fibres (a character inherent to the type), is below that of Egyptian cottons and its classification in this respect is low, although the defect could be corrected.

The best qualities are length of fibre and homogeneity. This cotton combines very well with wool for mixed fabrics which are now much manufactured in Paris. Cottons of a woolly type are greatly in request for this.

[1298-1299]

## Technological characters of the two samples.

Characters	1918	1920
Species . . . . .	<i>Gossypium peruvianum</i>	<i>G. peruvianum</i>
Place of origin . . . . .	New Hébrides	New Hébrides
Length of lint . . . . .	32.5 mm.	34.5 mm.
Average { lower grade . . . . .	20 mm.	30 mm.
{ upper grade . . . . .	37 mm.	39 mm.
Fineness of lint . . . . .	22.5 $\mu$	22 $\mu$
Average { lower grade . . . . .	20 $\mu$	29 $\mu$
{ upper grade . . . . .	25 $\mu$	25 $\mu$
Extremities . . . . .	fine	fine
Twist . . . . .	P. V. + M. V. = 40 % B. V. + T. V. = 60 %	P. V. + M. V. = 37 % B. V. + T. V. = 63 %
Elasticity { elongation . . . . .	below 10 % = 45 %	below 10 % = 40 %
{ elongation . . . . .	above 10 % = 55 %	above 10 % = 60 %
Tenacity . . . . .	8.65 gm.	9.67 gm.
Average { inferior . . . . .	7 gm.	6 gm.
{ superior . . . . .	11 gm.	10 gm.
Tenacity of thread of 0.1 mm. in diameter . . . . .	contains: 19.76 fibres tenacity = 176.84 gm.	contains: 20.66 fibres tenacity = 173.33 gm.
Colour . . . . .	white; very rarely, traces of red.	white; traces of red
Feel . . . . .	woolly	woolly
Defects . . . . .	Some ginning defects; fragments of seeds; fibres soiled with oil.	Imperfect ginning; fibres soiled with oil; fibres breaking to bolls being tacked by anthracnose.
Classification . . . . .	Above Middling	Below Middling
Lint yield . . . . .	33.6 %	34.4 %

purpose. The appearance of the cotton gathered in 1918 is superior that of the 1920 cotton.

The authors advise cotton-growers to take every care to preserve the crop from disease and to keep this variety pure, as it will be appreciated on the market.

F. C.

1300 - Production of Oil Seeds and Vegetable Oils in Bessarabia. — I. F. N. O. R. Statistics of areas sown in Roumania during the agricultural year 1920-1921, in *letinel Agriculturii*, Vol. I, No. 1-3, pp. 151-218. Bucharest, January-February 1922. Statistics of the agricultural year 1920-21, *Ibidem*, Vol. II, No. 4-6, pp. 105-153. Bucharest, April-May-June 1922. — II. The production of oil in Bessarabia in 1920 *Correspondance Economique*, Bulletin officiel de la Direction générale du Commerce, 12-13. Bucharest, June-July 1922. — III. GIRCEA, E., The production of oil in Bessarabia in 1920, in *Buletinul Statisticil României*, Series IV, Vol. XV, No. 8, 106-107. Bucharest, 1922.

The extent and importance of oil yielding crops in Bessarabia in agricultural year 1920-1921 are shown by the figures in Table I.

[1299-1300]

TABLE I. — *Area and production of oil yielding crops in Bessarabia, in 1920-1921.*

Crops	Area hectares	% of total crops	Production per hectare hectolitres	Total production hectolitres
flower . . . . .	20 806	0.85	11.6	240 639
mp . . . . .	10 704	0.44	5.0	55 655
seed . . . . .	2 580	0.11	2.0	5 229
pe . . . . .	3 239	0.13	1.2	3 773
py . . . . .	18	0.00	7.7	139
Totals . . .	37 356	1.53	—	—

The growth of these crops was divided up among the various classes of agricultural properties in the manner indicated in Table II.

TABLE II. — *Distribution of the oil yielding crops according to the size of properties (hectares).*

Crops	Large properties	Small properties	Peasant Societies
flower . . . . .	3 351	10 622	6 843
mp . . . . .	203	5 421	5 080
seed . . . . .	416	1 668	505
pe . . . . .	445	1 966	828

Table II shows that the most important part of the production of oil in Bessarabia belongs to small properties and Peasant societies (1). The manufacture of vegetable oils has considerable importance especially in the northern part of the Province, namely in the districts of Hotin, Ica, Băltri and Orhei.

(1) To give an idea of the development of the growth of oil-yielding crops in Bessarabia during the last 20 years, we take the following data from a recent publication of the International Institute of Agriculture; *Produits oléagineux et huiles végétales, Etude statistique leur production et leur mouvement commercial, Rome 1921*:— the annual average area under linseed and hemp for the five years 1901 to 1905 was 10 170 and 5886 ha.; in the following five years the respective figures were 5475 and 4592; in 1913, the last normal year before the war, the area under linseed was 8821 ha.; that under hemp was 6764 ha., and under rape 2585 ha. Regarding the area under sunflower, as data for 1913 are lacking, we take the figures for 1911:— 3421 ha. in the whole Province. A comparison of these figures with those of 1921 shows that the growth of sunflowers has developed more than that of other oil yielding crop during the last 20 years. (Ed.)

Table III shows, for 1920, the production of vegetable oils in Bessarabia, the quantity required for the consumption of the population and the quantity available for export.

TABLE III. — *Production, consumption and export (in quintals) of vegetable oils in Bessarabia in 1920.*

Oils	Quantity of oil produced	Quantity of oil required for the consumption of the population	Quantity of oil available for exports
Sunflower . . . . .	17 084	10 921	6 238
Linseed . . . . .	31	90	1
Hempseed . . . . .	5 432	6 603	213
Gourdseed . . . . .	272	748	16
Colza . . . . .	166	166	—
<i>Totals . . . . .</i>	<b>22 985</b>	<b>18 528</b>	<b>6 468</b>

Sunflower oil stands first; the centres of the growth of this crop are the districts of Soroka and Hotin which combined account for 13 483 q.

The quantities of hempseed oil, linseed oil and colza oil in excess of the figures for production and available for export are explained by the fact that stocks of the oils remained over from previous years.

Regarding the methods of oil manufacture in Bessarabia, in most cases they are quite primitive and by no means comply with modern technical requirements. Improvement in the methods of production of oils would increase the value of the production, which is already considerable, since in 1911 the total value of all oils produced in Bessarabia was about 33 millions of "lei".

I. G.

1301 — **Growth of the Castor-oil Plant in Morocco.** — CHAVEAU, C., in *La Vie technique industrielle*, Year III, No. 36 pp. 387-391, 5 figs. Paris, Sept. 1922.

The castor-oil plant is native and very common in the coast zone of Morocco, which proves that the plant can thrive in that area.

Soils known under the names "tell", "remel", "hamri" and "sahel" are very suitable for growing the castor-oil plant, for they are rich, especially the last two, in lime and phosphoric acid.

To the "tell" and "sahel" soils, the following mixture has been applied as manure:—

Sulphate or nitrate of ammonium . . . . .	100 kg
Superphosphate . . . . .	500 "
Sulphate of potash . . . . .	20 "

In the coast zone, which has an area of from 40 000 to 50 000 ha, the climate is very favourable for growing the castor-oil plant, for the ther

ometer never falls below  $+1^{\circ}$ , and the heavy night dew renders irrigation unnecessary. In these parts the castor-oil plant lives for about 10 years and assumes arborescent form.

The rainy season, which lasts from November to January, in no way interferes with the flowering and fructification of the plant which takes place from May to October.

Clearing ground costs about 600 fr. per ha., and the cost of manual labour for collecting the seed is not very high. The native castor-oil plant of Morocco belongs to the varieties *Ricinus zanzibarensis* and *R. minor*. These varieties produce seed in undiminished quantity for 5 to 7 years; the natives prefer to gather the wild product for they find it troublesome to cultivate a plant the seeds of which are gathered during a long period.

Experimental cultivation has given excellent results, quite equal to those obtained in the best producing countries.

*R. zanzibarensis*, on "sahel" soil has given a yield of 10 to 20 qx. per ha. according to the moisture of the soil, aspect of the ground and the quantity of manure given.

The oil made from these seeds is excellent; the writer consequently recommends the cultivation of the castor-oil plant on a large scale in the protectorate of Morocco, as the oil is much in request in the French market.

F. C.

302 - **Growth and Preparation of the Castor-oil Plant, in Brazil.** — FLORIANO, A., in *Revista da Sociedade Rural Brasileira*, No. XXVI, additional loose sheet, p. 3. Rio de Janeiro, Aug. 1922.

During the war the cultivation of the castor-oil plant developed enormously in the State of São Paulo, it then decreased in importance owing to the rapid fall in prices and difficulties of preparation. At present the export demand has again increased considerably.

In 1920, from the port of Santos alone, 360 000 bags of castor-oil seed were exported and in 1921, 230 000 bags over and above the quantities prepared in Brazilian factories, which have considerably increased their machinery. The present price (first half of 1922) is 460 *reïs* per kg. of husked seed and 500 *reïs* for machine husked seeds, or 25 *milreïs* per bag of 50 kg. The exporting firms are constantly receiving large orders from Europe and America. Castor-oil seed seems therefore likely to become an article of large export and a source of wealth for the State of São Paulo. The writer quotes the case of a planter of Quariba who obtained 500 bags of castor-oil seed from 29 ha. of land. The principal centres of cultivation are the district of Sorocobana and of the north-west of the State. Several manures containing a large proportion of castor-oil cake are on sale in São Paulo and are very suitable for manuring coffee. The writer recommends the extraction of the oil at the factory and the export of the oil, the cake from which would be a source of profit for the manufacturers.

F. D.

[1301-1302]

1303 - **Tanning Substances of Indo-China.** — HEIM, F. and CERCELET M., in *Bulletin de l'Agence générale des Colonies*, Year XIV, No. 1617, pp. 10 7-1035, with fig.; Year XV, No. 169, pp. 15-27, with fig. Melun, Dec. 1921. Jan. 1922.

These papers deal with a preliminary series of investigations of certain barks sent to the General Laboratory of Colonial Products by the Indo-China Distiller's Company.

**GIÉ-QUANG BARK.** — Gié-Quang is, according to CHEVALIER the local name for *Quercus pseudocornea* A. Chev., which yields an excellent building timber and is common in the Tonkin forests, and more especially in the South-East (Tien-Yen); the natives call it "Gié-Quang" in Annam and "Gié-Quong" in Tho. The bark contains 15.92 % of tannin, which is very easily extracted and is excellent for tanning boot leather.

**GIÉ-MANGA BARK.** — This is from an unclassified species of *Quercus* and was collected at Na-Sa in Tonkin. The tannin content is 10.37 %, but there is a large percentage of non-tannic substances among the soluble matter which renders this bark unsuitable for use in tanning.

**GIÉ-XANH or GIÉ-SANH BARK.** — This comes from an unclassified species of *Quercus* and was collected at Pho-Vy. It contains 7.05 % of tannin; it would therefore be suitable for making extract and should be used mixed with the other tans for treating sole leather.

**SOI BARK.** — The botanical identification of this species is difficult as the name Soi is applicable to oaks and is also used for some *Castanopsis* and for *Sapium sebiferum* (*Euphorbiaceae*) but this species must be excluded since it is not indigenous in Tonkin and is only found near villages. Analysis shows 12.17 % of tannin almost exclusively pyrogalllic; its colouring power is very high; this bark would be suitable for making extracts and might be used if mixed with other tans for treating sole leather.

**SOI-DA BARK.** — This comes from an unknown species of oak, but the same name is given to a tree of the family Styracaceae, *Symplocos ferruginea* Roxb. = *Symplocos javanica* Kurz., common in the forests of the middle region. It contains 8.85 % of tannin with a large quantity of soluble non-tannin substances; the tannin is almost exclusively pyrogalllic. This bark is suitable for making extracts. In tanning it should be used mixed.

The article is illustrated by photographs and drawings of microscopic preparations which show the structures of the barks examined. F. C.

1304 - **Tanning Substances of Tonkin.** — TARDIVOT, F., in *Bulletin Economique de l'Indochine*, Year XXV (N. S.), No. 152, pp. 28-34. Hanoi-Haiphong, Jan.-Febr. 1922.

The difficulties met with during the war, especially in 1918, in the importation of tanning substances into Tonkin have led to investigation of means of utilising the natural resources of the country in vegetable tanning substances. The investigation of these substances was made by means of the official method of powdered hide with chrome, the only method allowed by the International Association of Chemists of leather industries; in addition, some tanning tests were also made to ascertain any modifications of colour or quality caused by these tanning substances.

**MANGROVE BARKS.** — These have been supplied by Prof. CHEVALIER, Director of the Indo-China Scientific Institute, under the generic name

Indo-China mangroves. But these barks, although they contain large percentages of tannins and similar substances, cannot be utilised because of their colour and the defects which they cause in the leather.

àng (*Rhizophora mucronata* Link); tanning substances 15.33 %.  
 iróe hông (*Bruguiera gymnorhiza* Lour.); tanning substances 15.64 %.  
 iróe trắng (*B. gymnorhiza* Lour. var.); tanning substances 20.24 %.  
 hang vet (*Kandelia rheedii* W. and A.); tanning substances 21.83 %.  
 ong dinh (?); tanning substances 28.78 %.

GIÉ BARKS. — The natives call the Cupuliferae by the name gié, specially those belonging to the genera *Quercus* and *Castanopsis*.

Three samples from the Province of Thai-Nguyên yielded 9.67 % 5.50 % — 6.50 % of tannins respectively.

Three samples from the Phuto district yielded: — Gié-trắng 4.28 % Gié-tia 3.36 % — Gié-cháng 4.72 % of tannins.

Three samples from the Bac-giang district yielded: — Soi (*Quercus* sp.) 7.36 % — Soi cau (*Castanopsis* sp.) 8.24 % — Soi phạng (*Quercus* sp.) 9.04 % of tannins.

#### MISCELLANEOUS BARKS:—

Nghien ( <i>Nephelium</i> sp.?) . . . . .	1.73 % of tannins
Vai ( <i>Nephelium Litchi</i> Camb.) . . . . .	4.2 " "
<i>Quercus</i> sp. ? . . . . .	6.8 " "
Cáo ( <i>Enselhardia</i> ) . . . . .	7.6 " "
Mirong ( <i>Cassia</i> ?) . . . . .	11.4 " "

FLOWERS AND FRUIT OF CÂY BANG (*Terminalia Catappa* L.). — Contain a fairly large percentage of tanning substances:—

Dry leaves . . . . .	8.94 %
Dry fruit . . . . .	9 %

At tanning tests have not given satisfactory results.

#### WOODS:—

Soi phạng ( <i>Quercus</i> ) . . . . .	1.2 % of tannins
Lâm ( <i>Erythrophloeum Fordii</i> Oliv.) . . . . .	5.88 " "
Idem . . . . .	4.40 " "

The leaves of Cây voi (*Eugenia operculata* Roxb.) are not utilisable for tanning.

CUPULES OF THE ACORNS OF MA-LI-CHOU (*Quercus* sp.). — These come from Yunnan and are similar to cupules of the Valonia oak; they contain 10 % of tannins.

The writer concludes that it would be inexpedient, under present conditions, to exploit Indo-China resources of crude tanning substances unless very large plantations of mangroves are made and he raises the question whether in the future tanning will be done with vegetable tans, with synthetic tannin or with mineral salts.

F. C.

[1304]



1305 - **Cultivation of the Soil in Rubber Plantations.** — MAAS J. G. I. A. and RUT. RUTGERS, A. A., L., in *Medelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie*, No. 36, Year VI, No. 7, pp. 2-14. Buitenzorg, July 1922.

One of the writers, MAAS, explains some theories relating to the effects of tillage on the soil; these theories tend to prove the superiority of green manure to weeding. He then gives the results of some experiments made on 12 plots of land 1.6 ha. in area, planted with *Hevea*, situated in the State of Tandjong Merah; these results are summarised in the following Table.

Period	Difference between the average yield of unfertilised land and land manured with green manure.
Before weeding (1st Dec. 1916 - 1st Feb. 1917)	0.0 % $\pm$ 2.25
First period after weeding (1st May 1918 - 1st Nov. 1918)	+ 1.0 % $\pm$ 3.2
Second period after weeding (10 July - 25 Oct. 1919)	+ 5.0 % $\pm$ 3.6
Third period after weeding (1st Apr. 1921 - 1st Apr. 1922)	— 9 (approximate calculation)

These experiments prove that weeding does not have any beneficial effect.

RUTGERS next gives the results obtained in two estates in which weeding began to be done in 1917, and which gave an increased yield of over 100 %; this led to the system being introduced into several other estates. A critical examination of the monthly production in the first two estates, compared with that of three neighbouring estates, showed that the increased production took place not only in the two estates in which weeding had been usually done but also in the three others in which the ground remained constantly under weeds. Moreover, in the same estate, there had been a parallel increase in sections in which weeding was finished in August and in those where it was commenced in August.

In conclusion, there is nothing to show that the increased yield was due to weeding. A. d. B.

1306 - **The Root System of Hevea in various Soils.** — GRANTHAM, J. and BISHOP O. G., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year VI, No. 1, pp. 231-247, 16 figs. Buitenzorg, July 1922.

The writers have examined the development of the root system of *Hevea* in various soils and have arrived at the following conclusions:-

1) The root system of *Hevea* varies very much according to different soils. The height of the water table is the main factor of the limitation

f development of the roots. Mechanical resistance is a limiting factor in compact soils.

2) There is a general correlation between above-ground and underground development. Trees planted in sandy soil, with an extensive root system and poor development above-ground, are exceptions.

3) There is no correlation between good individual development of the roots and high production on the best types of soil, but only a certain relation on the poorest soils. The best soils, with the most extensive root system, give the best yield.

4) The typical appearance of the root system becomes apparent in youth (3 to 3 ½ years), but is less marked later. Differences in root systems in different soils at that age are greater than those in the foliage of the different trees.

5) As the lowering of the water table is of great importance it is very desirable to carry this out whenever practicable.

6) Although the breaking up of compact soils by means of explosives causes the mechanical resistance to decrease and may lead to the assumption that it is advantageous, experiments made gave negative results.

7) Soil improvements while the plants are young is recommended.

8) Root interference should be considered in connection with the question of thinning. In the case of the greatest root development observed the roots of a tree were interlaced with those of 58 other trees.

9) The root development just mentioned shows the possibility of a tree with diseased roots infecting a large number of other trees.

F. C.

307 - **Practical Examination of the Bark of Hevea and its Importance in Tapping.** —

VITEL, G., in *Bulletin de l'Association des Planteurs de caoutchouc et autres produits coloniaux*, Vol. IX, No. 6 and 7, pp. 119-122. Antwerp, June-July 1922.

When in 1918 Dr. BOBILLOF drew the attention of planters to the possibility of distinguishing good and bad rubber yielding trees by a simple examination of the structure of the bark, attempts were made to apply this method practically, but most of those interested continued to adhere to the old method by testing the latex produced by each tree.

Nevertheless the selection of good rubber producing trees is very important in young plantations in which thinnings have to be made: it is a mistake to go by the standard of the most vigorous tree, for it is not always the most vigorous tree which produces most rubber. On the other hand the standard of yield for the selection of trees to be left cannot be applied to very young plantations.

In such a case simple examination of the bark may give useful results, for it is known that there is a close connection between production and the number of layers of laticiferous vessels.

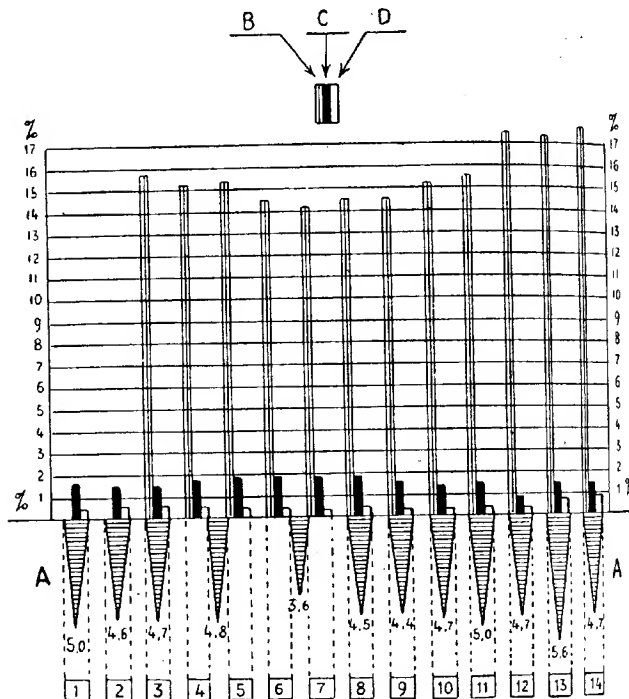
In using this method the following procedure should be adopted:—the trees in the plantation to be examined are serially numbered; a gang of three coolies then removes samples of the bark at a height of 50 cm.

[1306-1307]

1309 - On the Presence of Quebrachite and Sugar in the Latex of Hevea, according to different Circumstances. — SPOON, W., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year VI, No. 7, pp. 269-287. Buitenzorg, July 1922.

Substances having rotatory power and a sugary taste have been found in Hevea latex. The principal substance is a mono-methylinosite and

*Composition of latex at various times of the year.*



EXPLANATORY NOTE:

A = yield of rubber per tree per day; B = ash in dry matter; C = quebrachite in the serum.

1 to 14, see periods in Table I, p. 1507.

the others belong to the sugars. Data regarding these substances were often rather vague: the methods of determination and the calculation of their percentages were not always described very clearly. Some data regarding quebrachite were furnished by PICKLES and WHITEFIELD who found 0.46 %, while GORTER estimated the percentage at 1.45 %.

A certain number of *Hevea* trees on  $\frac{1}{4}$  of their garin.

Period	Latex		Grammes of rubber per tree per day	Serum + acetic acid						Que- brachite %	Sugar %			
	Cubic per tree per day	S. G.		Percent- age of rubber	S. C.	Dry matter %	Ash %	% of ash in the dry matter	$\alpha$			$\beta$	$\gamma$	$\gamma-\alpha$
April 1919 . . . . .	15	0.9826	32.6	5.0	—	—	—	—	20.26'	30.2'	—	—	1.79	0.33
May . . . . .	14	0.9820	33.6	4.6	—	—	—	—	20.3'	20.53'	—	—	1.67	0.45
June . . . . .	14	0.9813	34.3	4.7	1.01915	4.31	0.68	15.8	10.9'	20.52'	—	—	1.65	0.48
July, 1st half, . . . . .		0.9813		4.8	1.0204	4.64	0.70	15.1	20.22'	30.9'	—	—	1.84	0.43
" 2nd " . . . . .	14	0.9818	34.5		1.02085	4.66	0.71	15.2	20.46'	30.7'	—	—	1.88	0.19
August, 1st half . . . . .		0.9834		3.6	1.0209	4.68	0.68	14.5	20.32'	30.14'	20.57'	25'	1.90	0.38
" 2nd " . . . . .	11	0.9839	33.0		1.0193	4.545	0.64	14.1	20.43'	30.11'	30.5'	22'	1.90	0.25
September . . . . .	14	0.9839	32.0	4.5	1.0187	4.30	0.63	14.6	20.36'	30.14'	20.54'	18'	1.91	0.35
October . . . . .	13	0.9834	32.4	4.4	1.0187	4.30	0.63	14.6	20.32'	20.48'	20.46'	14'	1.69	0.15
November . . . . .	15	0.9839	32.0	4.7	1.0173	3.98	0.60	15.1	10.54'	20.11'	20.8'	14'	1.31	0.15
December . . . . .	16	0.9846	31.5	5.0	1.0173	3.87	0.60	15.5	10.52'	20.11'	20.4'	12'	1.31	0.17
January 1920 . . . . .	15	0.9848	31.3	4.7	1.0169	3.69	0.64	17.4	10.24'	10.39'	10.43'	19'	0.99	0.14
February . . . . .	17	0.9839	31.9	5.6	1.0174	3.815	0.66	17.3	10.46'	20.30'	20.4'	18'	1.44	0.40
March . . . . .	15	0.9841	31.8	4.7	1.0175	3.89	0.68	17.5	10.29'	20.18'	10.43'	14'	1.31	0.45

[1309]

CAMPBELL, who found that natural coagulation of latex depends on an enzyme, remarks that several enzymes are compounds of protein and carbohydrates and that in this case it is possible that the monomethylinosite may form the greater part of the enzyme in *Hevea latex*.

On account of the different methods employed, it is difficult to find in the literature on the subject the exact figure for the quantity of sugar.

PARKIN who said that this sugar appeared in every respect similar to saccharose, estimates the quantity at 0.3-0.7 %.

BEADLE and STEVENS found 0.34 % and 0.79 % of sugar (calculated in the rubber as glucose) in two samples of *Hevea latex*. GORTER gives 0.25 % as the figure for the sugar; GROENEWEGE was able to make sure of the presence of fermentable sugar in the latex. He calculated a glucose content of 0.9 gm. per litre of serum.

The writer in making experiments regarding the quantities of quebrachite and sugar present in *Hevea latex* was mainly concerned about finding a good method of determination, as methods previously described in the literature on the subject were wanting in precision. The ordinary method for the estimation of sugars by reduction of Fehling's solution could not give exact results in this case for the reaction was complicated by the presence of other constituents of the latex (probably proteins). Another well known method for the estimation of sugar is the determination of the rotatory power.

There are three distinct groups of substances in the latex which deflect rays of polarized light, namely quebrachite, glucose and protein. VERNER thinks that the polarimeter cannot be used on account of the proteins; they must therefore be first eliminated. The specific rotatory power of quebrachite is known; the identity of the sugar has not been recognised properly, so that the figure indicating its specific rotatory power cannot be obtained; the same is true for the proteins. Apparently therefore there are sufficient reasons for supposing that there is saccharose, the specific rotatory power of which is known, in the latex; on this hypothesis the use of the polarimeter becomes possible. The writer describes the method which he used for the investigation and estimation of these substances in the latex and he explains the formulae which he used for determining the specific rotatory power. His results are given in Tables I and II.

The daily quantity of latex per tree is almost constant from May to November, but the quantity of rubber is very irregular. Towards the end of the experiments, mineral substances tended to increase, while there was a marked decrease in quebrachite.

The greatest differences were found in January and February 1920, when the seed was falling.

Other experiments were made with another group of trees divided into 2 lots which were first tapped simultaneously (see Table II); then lot A was tapped daily by a  $\frac{1}{2}$  circumference incision (see Table III), while lot B was tapped every other day (see Table IV).

In group B of trees first tapped daily as control trees and afterwards

TABLE II. — Groups of trees A + B.

Period	Cubic cm. of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Serum + acetic acid					
				$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
4/20-19/4	15	48.9	7.5	1°20'	2°20'	—	—	1.30	0.55
4 -17/4	35	41.7	14.7	1°45'	2°27'	2°5'	20'	1.42	0.38
4 -24/4	42	36.2	15.1	1°54'	2°10'	2°20'	26'	1.30	0.15
4 -1/5	42	31.8	13.4	2°5'	2°23'	2°21'	16'	1.43	0.16
5 -8/5	39	29.1	11.4	2°0'	2°22'	2°30'	24'	1.43	0.15
5 -13/5/20	40	29.0	11.4	—	—	—	—	—	—

TABLE III. — Trees of group B, tapped daily.

Period	Cubic cm. of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Serum + acetic acid								
				Dry matter	Ash	% of ash in the dry matter	$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
5/20-22/5 . .	32	29.0	9.4	3.96	0.65	16.4	2°26'	2°49'	2°42'	16'	1.69	0.21
5 -29/5 . .	29	28.7	8.4	4.15	0.66	15.9	2°40'	2°59'	2°44'	4'	1.80	0.17
5 -5/6 . .	28	28.5	8.0	4.09	0.67	16.4	2°31'	2°45'	2°39'	8'	1.67	0.13
6 -12/6 . .	23	28.5	6.6	4.09	0.68	16.6	2°28'	2°48'	2°32'	14'	1.69	0.18
6 -19/6 . .	22	29.5	6.5	4.16	0.69	16.6	2°27'	2°49'	2°33'	8'	1.69	0.20
6 -26/6 . .	23	31.6	7.3	4.18	0.65	15.6	2°6'	2°35'	2°19'	13'	1.53	0.26
6 -1/7/20 .	23	31.6	7.2	4.08	0.67	16.4	2°5'	2°27'	2°22'	17'	1.47	0.20

TABLE IV. — Trees of group B.

Period	Cubic cm. of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Serum + acetic acid								
				Dry matter	Ash	% of Ash in the dry matter	$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
Tapped daily												
5/20-22/5 . .	51	26.8	13.7	3.79	0.65	17.2	2°15'	2°28'	2°35'	20'	1.50	0.12
5 -29/5 . .	45	26.5	11.9	3.92	0.68	17.3	2°20'	2°36'	2°29'	9'	1.57	0.15
5 -5/6 . .	40	26.7	10.7	3.94	0.69	17.5	2°12'	2°35'	2°18'	6'	1.54	0.21
Tapped every other day												
6 -12/6 . .	35	28.2	9.9	4.00	0.68	17.0	2°14'	2°34'	2°20'	6'	1.54	0.18
6 -19/6 . .	37	30.3	11.1	4.12	0.69	16.7	2°2'	2°36'	2°10'	8'	1.53	0.31
6 -25/6 . .	33	32.5	10.7	4.16	0.68	16.4	1°50'	2°24'	2°5'	15'	1.40	0.31
6 -1/7/20 .	34	34.0	11.6	4.16	0.69	16.6	1°40'	2°26'	2°1'	21'	1.40	0.47

every other day, an increased rubber content was noticed, corresponding with an increase of sugar, while the content of mineral substances decreased. The yield of latex decreased by 40 % per tree during the first month following the change in the method of tapping. Other experiments have shown that production increased gradually in the following months. However the experiment was too short to allow of new and definite conclusions being drawn.

F. C.

1310 — **A Note on the Sugar in Hevea Latex.** — VAN DILLEN, I. R., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, pp. 263-268. Buitenzorg, July 1922.

A few writers have given figures regarding the quantity of sugar found in Hevea latex, but very little is known regarding its determination. This sugar has never been identified.

The writer made an investigation of the dialysed part of latex; it was only after inversion that he was able to determine the sugars by their reducing action on Fehling's solution.

The inverted dialysed portion was treated with sulphite of phenylhydrazine; it was thus possible to isolate the glucosazone and the galactosazone.

Latex perhaps contains some ethersaccharides, which give as decomposition products either glucose or fructose, or both sugars simultaneously, and galactose.

The writer does not consider it likely that saccharose is found in latex.

F. C.

## SUGAR CROPS

1311 — **Palm Sugar in Cambodia.** — CARDOT, J., in *Revue d'Histoire Naturelle appliquée*, 1st part, Vol. III, No. 6, pp. 182-186. Paris, June 1922.

In Cambodia, in addition to the manufacture of cane sugar, an industry which is very extensive in the countries of the Indo-Chinese Union, there is a small local industry which makes use of the sap of a palm (*Borassus flabelliformis*) which is widely disseminated in the district. This palm may attain a height of over 20 m. and has a crown of leaves in the form of a fan, to which it owes its specific name: this palm is dioecious, and if an incision be made at the right time in the staminiferous and especially, in the pistilliferous inflorescences, it yields a sweet sap which is collected in special bamboo receptacles from 10 to 15 cm. in diameter and from 25 to 30 cm. long; these receptacles are called "ampong" and are changed twice a day, care being taken to revive the incision. Generally, two inflorescences only are treated at the same time on each tree, all the flowers being first nipped off by means of wooden pincers. The harvest begins in November or December and continues till April or May. CASSIN estimates the average daily yield of each tree at 3 litres during the first 3 months, and half this quantity during the following 3, bringing the total production to about 40 000 litres. CREVOST and LEMARIE consider that 6 to 7 litres of liquid are required to produce 1 kg. of sugar; each tree therefore would yield about 60 kg. of sugar. But the production of the different trees varies greatly, and it often happens that, for some unknown

ason, some trees produce scarcely any sugar, and these are then abandoned after a 3-years trial.

The task of collecting is very dangerous, because the men have to climb to a great height on very light ladders made of bamboo stems.

The *Borassus* is of very slow growth: the tree cannot be utilised until after 20 or 30 years and its productive period lasts about 20 years.

The sweet liquid may be drunk when fresh, but it soon becomes acid; fermentation and the addition of pepper, cardamom and ginger, a palm wine is made which is much appreciated by the natives.

The sugar is manufactured by first placing in the "ampong" a piece of *Pepel* or *Doeum pepel* (*Shorea cochinchinensis*), a tree of the Dipterocarpaceae family, which is said to prevent or delay fermentation. The liquid is then filtered, boiled in an earthenware pot and reduced to half its volume; the semi-liquid substance thus obtained is poured into moulds formed of strips of *Borassus* leaves rolled into a circle and arranged on a board. After some time, the cakes become completely solidified and are of various sizes; they weigh from 23 to 200 gm. each. In March towards the end of the season, the crystallisable sugar forms almost immediately into glucose, and then molasses only can be obtained, which is sold in earthenware jars. The molasses is in strong request by the Chinese distillers, who make kind of alcohol from it which they mix with arrack.

An analysis of the sugar made by BERTRAND gave the following results:

Water (moisture) . . . . .	2.6 %
Saccharose (ordinary crystallized sugar) . . . . .	89.2
Inverted sugar . . . . .	4.2
Various organic matters . . . . .	2.3
Ash . . . . .	1.6

Distilling tests have given 51 litres of alcohol per 100 kg. of sugar. Considerable quantities of this sugar are produced because, over and above that required for local consumption, a certain quantity remains for exportation. The Commercial Agricultural Departments of Cambodia have recently reported to the Economic Agency of Indo-China that there is an annual available quantity of 10,000 qx. of sugar loaves and 12,000 qx. of molasses.

The sugar is excellent, of an agreeable flavour and may be employed in making confectionery.

F. C.

12 - **The Cultivation of Tobacco in the Crimea.** — *Economicskaia Sizu*, no. 225. Moscow, 1922.

According to investigations made, thanks to the initiative of the tobacco Syndicate, on 500 farms where tobacco is grown in the Crimea, the situation of the growth of that plant in that area is shown in the annexed table (p. 1512).

In the last few years tobacco plantations have been given up in favour of cereals, or converted to grass or left entirely uncultivated. Live and dead stock are very much reduced. On 50 % of the properties which have been inspected no greenhouses, glass or frames exist; in 40 % they are in an abandoned condition; only 10 % have maintained their greenhouses. I. G.

[1511-1512]

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS



Years	Number of plantations	Area in <i>déciaïnes</i>	Yield in <i>pouds</i>
1911	7200	3400	260000
1914	5200	2800	220000
1917	5600	3200	200000
1919	4000	2100	120000
1920	3200	1500	150000
1921	—	530	10000
1922	—	200	—

1 *déciaïne* = 1.0925 ha. — 1 *poud* = 16.38 kg.

1313 — **Nicotine Content of South African Tobacco.** — JURITZ Chas. F. (Chief Division of Chemistry), in *The South African Journal of Industry*, Vol. V, No. 8, pp. 347-366, bibliography of 6 publications. Pretoria, Aug. 1922.

In consequence of a proposal to start a factory for tobacco extracts in the Transvaal, the writer was instructed by the Minister of Agriculture to make estimations as to the nicotine content of various species of South African tobacco; he obtained the following results:—

1) The heavy South African tobacco, grown at Barberton, Pieter Retief and Potchefstroom, contain in their air dried leaves, from 3 to 5% of nicotine.

2) The nicotine content of the leaves of light tobaccos does not generally exceed 2% and often does not even reach 1%.

3) The leaves of the common wild tobacco (*Nicotiana glauca*) contain, according to the few analyses made, decidedly less than 1% of nicotine.

4) *Nicotiana rustica* gives the best results; its leaves contain 1 to 8%, or even more, nicotine; this alkaloid is more abundant in the leaves, but all parts of the plant, stalks, flowers and roots, also contain it.

If it is permissible to draw any general conclusions from a single series of experiments, it appears that in young transplants the leaves contain a small percentage of nicotine, generally less than 1%; this percentage increases rapidly up to 2% six weeks after transplanting; it approaches 3% two months later and reaches 6-8% when the plant is fully mature.

A. de B.

#### HORTICULTURE

1314 — **Notes on the Cultivation of the Pineapple** (1). — KOPP, A., in *Revue de Botanique appliquée et Agriculture coloniale*, 2nd Year, No. 13, pp. 483-509. Paris, Sept. 1922.

A general article on our present knowledge of *Ananassa sativa* L. in which the writer has considered the different works published on the subject for the last twenty years.

(1) See also: — R. March 1911, No. 849; R. April 1913, No. 440; R. Aug. 1915, No. 798; R. Oct. 1914, No. 967; R. Jan. 1917, Nos. 106 and 114; R. June 1917, No. 60; R. Dec. 1917, No. 1239; R. Feb. 1918, No. 243; R. Sept. 1918, No. 995; R. Oct. 1918, No. 1125; R. Nov.-Dec. 1920, No. 1119; R. July 1922, No. 790. (Ed.)

[1312-1314]

That cultivation has considerable interest, for it extends to nearly all tropical countries.

The principal varieties relating to each country are enumerated and described. The writer examines particularly the natural conditions required for the growth of pineapples and especially the question of manures, question on which different writers do not agree, particularly as regards the season and the relative importance of various phosphate manures.

Systems of planting, reproduction and cultural operations form the subject of a long careful examination. Methods of despatch, packing, and preserving are passed in review in the various countries.

The pineapple as a source of fibre is also noted; on this subject cultural peculiarities relating to pineapples grown for fibre are mentioned, particularly as regards the spacing, which should be closer than in the case of pineapples grown for fruit.

The most important chapter is that which deals with pests and diseases of the pineapple.

**PHYSIOLOGICAL DISEASES.** — These are no doubt due to the physiological conditions of the soil. "Spike" or "Long leaf" is a deformation of the leaves. Plants affected seldom produce fruit. This disease is attributed to the chemical composition of the soil. Writers are not agreed as to the cause. It is thought that the disease is hereditary; 80 % of the plants produced by diseased pineapples are affected by "Spike". It is recommended to destroy the diseased plants or not to use plants raised from them for planting. "Tangelroot" or entanglement of the roots is without doubt due to the physical condition of the soil.

"Chlorosis" shows itself by a discolouration and by the vegetative system turning more or less yellow. Spots first appear on the leaves. This is due to disappearance of the chlorophyll. This disease is prevalent in badly drained over-calcareous soils. The iron content of the plant becomes greatly reduced; consequently, washing the leaves with sulphate of iron is recommended. It has been noticed that, of calcic compounds, only carbonate of lime is injurious; a large amount of organic matter removes this effect, also a strong alkalinity of the soil (carbonate of soda). By growing in the shade, the destruction of the chlorophyll is delayed, which mitigates the disease. It should be noted that chlorosis may appear as a consequence of bacterial disease.

**FUNGOID DISEASES.** — These are the following:— "Blight" or "wilt" (wilting), caused by a *Fusarium*. It is controlled by pulling up the affected plants; before replanting care is taken to disinfect the soil with quick-lime or sulphate of copper.

"Black heart" or "bitter heart"; the fruit becomes watery; the causes of this disease are obscure and no effective remedies are known.

"Leaf Spot" or brown spots on the leaves; this disease seems to be connected with weather conditions.

"Core-root" or decay of the eyes of the fruit; it is thought that this disease is due to *Monilia candida*.

Among fungi attacking the fruit may be mentioned:— *Chalara*

*paradoxa* (*Thielaviopsis paradoxa*) which affects the colour and texture of the fruit.

INJURIOUS INSECTS. — Most of them are Hemipteræ, Diaspidæ or Coccidæ:— *Diaspis bromeliæ* (Hawai), *Aspidiotus bromeliæ* (Azores & Canaries), *Dactylopius* or *Pseudococcus bromeliæ* (America, Hawai, South Africa, Uganda), *D. longispina* (New Guinea, Queensland), *D. or P. citr*

*Pseudococcus bromeliæ* has parasites:— *Diadiplosis pseudococci* Felt, *Blephyrus tachygalia* Brues., *Coccidiotrophus socialis* Schwatz and Bake, *Eumaisibius wheeleri* S. and B., *Pinnaspis buxi* and *Chrysomphali bifrons* attack *Bromelia Pinguin* at Porto Rico. *Solenopsis geminata* has also been found. In Northern Australia white ants are very injurious to pineapples.

Among the Coleopteræ are mentioned *Metamasius ritchiei*, *M. sericea* and *Cholus watsoni*. Among Hymenopteræ, the larvæ of *Hyphocampe philippus* attacks the fruit.

Thrips and Mites, as well as *Stigmaeus floridanus*, also attack pineapples.

Lastly it should be noted that porcupines are particularly fond of pine apples.

P. C.

#### FRUIT GROWING

1315 — **Cherry Growing in Wisconsin, U. S.** — ROBERTS R. H., in *Agricultural Experiment Station of the University of Wisconsin, Bulletin* 344, 30 pp., 29 figs. Madison June 1922.

The Bulletin reviewed gives arboriculturists rules based largely on results of scientific research.

GROWTH. — The growth of the tree and the crop being two correlated facts, cultural methods should be based on the development of the tree which should be brought to the stage in which a large number of fruit buds are formed. To obtain abundant crops it is generally necessary that most of the terminal and principal side branches should increase each year by 35 to 45 cm.

MANURES. — Very productive orchards are generally manured. Farmyard manure applied to cherry trees gives good results; if none is available it may be replaced by chemical manures.

It does not appear that phosphate or potash manures are very beneficial (at least in the conditions in the Sturgeon Bay district where the experiments were made); they are, however, often necessary for the undergrowth (which serves as green manure). Nitrogen in quickly assimilable form (nitrates or sulphate of ammonia) has given very good results in several cherry orchards; these manures are generally given to the extent of 1.5 kg. per tree, two or three weeks before the trees begin to flower. Nitrogenous manures retard considerably the date of ripening, especially in the case of trees with thick foliage; this delay is not prevented by the use of other fertilizers; it appears therefore to be inevitable in cherry orchards in which sustained heavy production is desired.

CULTIVATIONS. — Tilling the soil should be continued even after the crop is picked so that the tree may not stop ripening its wood too quickly.

[1314-1315]

1. if this process is prolonged, larger fruit and consequently a better crop will be obtained. In 1920, when scanty rainfall rendered cultivation more effective, cherry trees in orchards, which were well tilled produced, in the following year, fruit 18 % larger in the case of the Richmond variety and 15 % larger in the case of the Montmorency variety, than fruit produced by cherry trees under identical conditions except that tillage had ceased at an early date.

PRUNING. — This is essential if manuring and tillage is to give an abundant crop. It is recommended that the tree should not be allowed to grow tall, to top it early, to arrange that the main branches are as even as possible, by pruning more drastically those which tend to become ridget. Trees which produce badly generally remain poor yielders indefinitely; it is therefore well to improve them by drastic pruning.

In 1919 an experiment was started in Door County (Wisconsin) to ascertain the amount of pruning which would be effective and at the same time would not diminish the crops of the early years. A comparison was made between light and heavy pruning on the two principal varieties grown:— Early Richmond and Montmorency (eight year old trees planted 16 m. apart in squares) and it was noticed that, compared with unpruned trees, both light annual pruning and heavy pruning followed by periodical light trimmings, diminished, indeed, the "fruiting area" (number of flower buds per tree), but increased the yield, for a larger percentage of the remaining buds produced ripe fruit. The unpruned trees in all cases suffered a heavy fall of immature fruit. The control trees (unpruned), the trees pruned heavily and those lightly pruned yielded on the average, respectively:— Early Richmond 15.3 l. — 18.7 l. — 20.8 l. of cherries per tree; Montmorency 39.7 l. — 49.3 l. — 42 l. per tree.

INDIVIDUAL VARIATIONS. — The productiveness of trees depends on their growth rather than on the treatment applied to them. Cherry trees that produce badly remain bad producers, compared with heavy cropping trees whether pruned or manured or both together. Apparently, there is some correlation between the type of flower buds and productiveness; trees with a high percentage of spurs are good producers; the varieties which have the best system of spurs are more productive than those whose stem of spurs is bad, particularly in year following a cold winter. This as the case, for instance, with the Montmorency variety; in 1920-21 (year with a cold winter) there were counted:— 1) *Richmond variety*, 14 trees respectively 8860 — 9913 — 11832 — 12218 flower buds, percentage of flower buds borne by spurs 36.8 — 45.3 — 38.7 — 54.3; yield of cherries per tree 27 — 29 — 33 — 44 litres; 2) *Montmorency variety* on 4 trees respectively 10304 — 11283 — 13303 — 15550 flower buds; percentage of flower buds borne by spurs 31.2 — 38.8 — 53.8 — 30; yield 33 — 33 — 41 — 47 litres of cherries per tree.

Observations have shown that there is close correlation between the number of flower buds killed by frost in winter and the growth of the tree.

The buds which are in the most advanced stage of development at the beginning of winter are more liable to be killed by frost. Generally the

pre-winter development of flower buds is more noticeable on trees of slow growth. It is therefore not good to stop the early ripening of the wood for though in such cases resistant branches are formed it is nevertheless true that this advantage is to a great extent counteracted by the fact that these branches bear flower buds which stand cold badly. It is therefore better to run the risk of the death of the young branches, much less likely in Wisconsin conditions, in the case of branches which in a good season have not grown longer than 60 cm.

The flower buds borne on the spurs are more resistant to frost than those which are borne on the sides of long branches. During the winter from 1918 to 1920 frost damaged: — a) *Richmond variety*: — lateral buds 80.9 — buds on spurs 40.8 — average number of flower per bud — lateral 1.76; on spurs 2.39 — flowers per 100 buds: — lateral 33.6 on spurs 141.4 — b) *Montmorency variety*, respectively 65.6 and 26.1 — 1.79 and 2.24 — 61.5 and 165.4. These results explain why trees which have most spurs yield the best crops.

The effect of cultural treatment on the resistance of the buds is shown by the average for 1920-21: — percentages of flower buds dead on spurs: — Control trees (neither pruned nor manured) 46.3; pruned 34.0; pruned and manured 22.4; this was for the *Richmond variety* — respectively 25.6 — 10.0 — 6.4 for the *Montmorency variety*. Trees of insufficiently vigorous growth had 43.5 % and 17.0 % of flower buds on spurs killed by cold respectively for *Richmond* and *Montmorency* varieties, against 10.4 % and 4.9 % for trees of very vigorous growth.

POLLINISATION AND FRUCTIFICATION. — The *Richmond* and *Montmorency* varieties are autogamous and are able to cross-fertilise each other. Insects take no part in such fertilization; it is helped by wind: the position of the flowers is such as to assure natural fertilization by pollen falling from the flowers higher up the tree. The fall of immature fruit is not due to a failure of fertilization; all which were examined had been fertilised. Cultural attention affects fructification (percentage of flowers which develop into ripe fruit) as early as the following year, but the yield of a tree depends on the treatment it has received throughout its life. In observations made on *Montmorency* cherry trees brought under treatment in 1919 the figures were respectively for the control trees (unpruned and without manure), for a tree heavily pruned, for a tree moderately pruned, for a tree pruned and manured with nitrate of soda: — in 1919: — 31.3 — 48.8 — 39.7 — 49.2 cherries per 100 flowers — in 1920: — 30.9 — 44.8 — 39.2 — 42.9 % — in 1921: — 32.4 — 43.7 — 42.6 — 43.3 % — average: — 31.7 — 45.8 — 45.1 — %. The effect of treatment is specially noticeable 2 years later. F. D.

1316 — **The Date Palm in Irak.** — Dowson, V. H. W., in *Agricultural Directorate Ministry of Interior, Mesopotamia*, Mem. III, Part. I, pp. 1-75, 54 figs., 1 map. Part II, 14 synoptic plates, 3 geographical maps, 4 diagrams. Cambridge, 1921.

The Irak date palm belongs botanically to the order *Palmeae*, gen. *Phoenix* sp. *dactylifera* L. The Shat Al'Erab Arabs divide the life of this palm into 5 periods: —

[1315-1316]

1) "Farakh" . . . . .	0 - 8 years after the 1st app. of the bud on the mother palm after planting out	3 - 9	"	"	"	"
2) "Khita" " " " "	4 - 20	"	"	"	"	"
3) "Neshwa" " " " "	5 - 30	"	"	"	"	"
4) "Rabaya" " " " "	12 - 60	"	"	"	"	"
5) "Tawila" " " " "	30 - 100	"	"	"	"	"

The date palm is mainly distributed in the following areas:— Taflet in Morocco, Biskra in Algeria, Jerid in Tunisia, Fezzan in Tripolitania, in the Middle Nile valley, in oases in Arabia (Mecca, Medina, Jouf, Hofhoof, Jassa, Mascot, etc.). The largest area of its distribution, however is Irak. The date palm has recently been introduced into Arizona, Damaraland, Namaqualand and Australia.

In gardens where date palms are grown intercalary crops of other plants are easily arranged; in Irak the following are mainly found:—

A) TREES: *Juglans regia* — *Morus alba* — *Cydonia vulgaris* — *Ficus Carica* — *Pyrus Malus* — *Prunus persica*, *P. armeniaca*, *P. domestica*, *P. Cerasus* — *Citrus Medica* sp. et var. *acida* et *Limetta*, *C. aurantium* sp. et var. *Bigaradia* et var. *indët.*, *C. decumana* — *Mangifera indica* — *Zizyphus vulgaris*, *Z. Spina-Christi* — *Vitis vinifera* — *Punica granatum* — *Olea europaea* — *Musa paradisiaca* — *Opuntia Ficus-indica*.

B) HERBACEOUS PLANTS: *Allium Ceba* — *Beta vulgaris* sp. et var. *Nicta* — *Spinacia oleracea* — *Brassica oleracea* — *B. campestris* — *Raphanus sativus* — *Hibiscus esculentus* — *Daucus Carota* — *Solanum Lycopersicum* — *S. tuberosum* — *S. Melongena* var. *esculentia* — *Lactuca sativa* — *Cynara Scolymus* — *Allium sativum*, *A. porrum* — *Lepidium sativum* — *Portulaca* sp. — *Trigonella Foeniculum-graecum* — *Apium graveolens* — *Petroselinum sativum* — *Foeniculum officinale* — *Mentha piperita*, *M. viridis* — *Lagenaria vulgaris* — *Cucumis Melo*, *C. sativus* sp. et var. — *Citrullus vulgaris* — *Cucurbita Pepo* sp. et var. — *Vicia Faba* — *Phaseolus Mungo* — *Vigna Catjang* — *Capsicum annuum* — *Oryza sativa* — *Triticum* spp. — *Hibiscus cannabinus* — *Gossypium* spp. — *Medicago sativa* — *Lavosonia inermis* — *Arachis hypogaea* — *Sesamum indicum*.

The writer investigates in turn the soil conditions, cultivations, the problem of irrigation, methods of fertilization, harvesting and propagation. The date in ripening passes through 5 stages which the Irak Arabs call "Chimiri," "Khalal," "Rabab," "Tamar"; at Aden the 2nd and 3rd stages are called "Karra" and "Batta". During these stages the dates change in shape and colour.

The change of colour differs according to the varieties, especially during the "Khalal" stage when the dates may be yellow, red, yellow with red spots, etc. Dates for export should not be picked too ripe, for if the journey is long, ripening is completed during transit. The varieties exported from Basra are especially:— "Istaamran", "Halawi", "Khadhrawi", "Zahidi"; those exported from Northern Irak:— "Zahidi", "Khastawi", "Khadrawi." The export is considerable as, shown by Table I, which gives the value in lakhs of rupees (1 lakh of rupees is worth 1000 pounds sterling at par) of the date export from Irak in 1919:—

TABLE I. — *Export of dates from Irak in 1919.*

Destination	In boxes	In baskets	Total
United Kingdom . . . . .	111	0	111
British India . . . . .	39	34	73
United States and other countries . . . . .	52	2	54
Arabia . . . . .	12	11	23
Persia . . . . .	1	1	2
<i>Totals . . . . .</i>	<b>215</b>	<b>48</b>	<b>263</b>

In 1919, dates predominated in the export trade of Basra, as shown by the following figures:—

Dates . . . . .	217 lakhs of rupees
Wheat . . . . .	27 " " "
Wool . . . . .	15 " " "
Hides . . . . .	7 " " "
Horses . . . . .	2 " " "

*Total . . . . . 268 lakhs of rupees*

TABLE II. — *Export of dates from Basra from 1910 to 1912 and from 1917 to 1919 (in lakhs of rupees).*

Years	Dry dates	Fresh dates	Total	Remarks
1910 . . . . .	48	15	63	Figures from Consular reports
1911 . . . . .	53	16	69	
1912 . . . . .	58	12	70	
1917 . . . . .	3	70	73	Customs figures
1918 . . . . .	1	40	41	
1919 . . . . .	2	217	219	
<i>Totals . . . . .</i>	<b>165</b>	<b>310</b>	<b>535</b>	

*Average for the 6 years: = 89.*

TABLE III. — *Imports into India from 1910 to 1914.*

Years	Quantity in thousands of tons	Approximate value in lakhs of rupees
1910-1911 . . . . .	14	22
1911-1912 . . . . .	12	19
1912-1913 . . . . .	12	17
1913-1914 . . . . .	10	19
<i>Averages of the 4 years . . . . .</i>	<b>12</b>	<b>19</b>

These figures are for total imports; imports from Irak are consequently included in them.

TABLE IV. — *Quantities of dates exported from Basra in 1917 classified according to the principal varieties.*

« Syer » (« Istaamran ») . . . . .	36 576 tons
« Halawi » . . . . .	25 900 "
« Khadrawi » . . . . .	15 240 "
« Zahidi » . . . . .	4 064 "
Total. . . . .	81 780 "

Their value was estimated at 73 lakhs of rupees. Packing is done in bags, baskets made from palm leaves, hides, one pound cartons, 10 pound boxes, wooden cases containing 68 pounds net weight.

The following portions of the tree are made use of: — the trunk of the date palm as timber — the pith of the growing point which is very nutritious — the fibre — the fronds — the mid-ribs of the fronds — their axes — the leaflets — the stalk of the bunches of dates.

DISEASES AND PESTS OF THE DATE PALM:—

- A) A saprophyte, not very injurious, observed at Basra in 1920 on the trunk of date palms by Major C. R. WIMSHURST.
- B) A *Tetranychus* (*Arachnidae*), observed in 1918 by Dr. BUXTON.
- C) *Parlatoria blanchardii* (*Coccidæ*), common on the leaves of young palm and which cause serious injuries.
- D) An *Oryctes* (*Coleoptera*) the larvæ of which attack the crown of the leaves.
- E) The larvæ of a longicorn beetle (*Coleoptera*) which penetrates into the pith.
- F) Trunk borers of the family of the *Gelechiidæ* (*Lepidoptera*) seriously injured date palms in Irak in 1918, 1919 and 1920; the inflorescences were attacked by the small larvæ of this moth.

This is, perhaps, the most dangerous pest of the date palm.

At the end of the 1st part of his paper the writer collects in a short vocabulary the Arab words used and explains them.

The 2nd part of the paper is entirely devoted to the results of an inquiry made by the writer in 1919 on the yield of the date palm in Shat Al Arab. The writer has collected in a series of synoptic tables:— the number of varieties of female date palms in the district (about 50) — the distribution of the gardens in which date palms are exclusively grown and of those in which other fruit trees are also grown — data of the yield per garden, per variety and per tree — a list of the gardens with the numbers of date palms and the names of the owners — the percentage of date palms (78 %) and that of other fruit trees (22 %) grown in the district — the percentages of different varieties of date palms ("Istaamran" 45 %, "Halawi" 32 %, "Khadrawi" 8 %, "Dairi" 4 %, "Zahidi" 3 %, other varieties 8 %).



The paper ends with a bibliographical index of publications relating to the date palm. F. C.

## VITICULTURE

1317 - **The Viticultural Wealth of Greece.** — HASSIOTIS, S. (Director at the Ministry of Agriculture), in *L'Economiste d'Athènes*, Year II, No. 25, p. 389. Athens,  $\frac{2}{15}$  May 1922.

Greece at present cultivates about 2 million *stremmes* (1 *stremme* = 10 *ares*) of land under vines. About  $\frac{1}{8}$  of this area is made up of vineyards of Old Greece. Vine growing is relatively very restricted in the new Provinces, except in the island of Crete.

Moreover, phylloxera had destroyed a large part of the vines in Macedonia and Thrace. Thanks to the strict measures taken in Old Greece the vines there have been protected from every attack of the disease. Nurseries of American vines are prepared for replacing vines destroyed by phylloxera and at the same time measures for the control of the disease are studied. The production of must in Greece amounts to 3.6 million hectolitres a year, a quantity relatively small in comparison with the area cultivated. Intensive culture, the employment of chemical manures and an extension of the measures of control against various disease of the vine, especially mildew and oidium, would increase the yield very much. The vineyards of Greece fully suffice for the home consumption of wine and spirits and also allow of the export of fairly large quantities annually.

In 1920, Greece exported to foreign countries:—

Must	403 177 kg.	to the value of	163 566 drachmas
Wine	28 404 218 " " " "	" " " "	22 172 374 "
Brandy	736 543 " " " "	" " " "	4 532 409 "
Lees	736 543 " " " "	" " " "	2 273 432 "

Total . . . 29 141 781 drachmas

These figures are certainly not remarkable for a country where the vine is under the best conditions for growth. Intensive cultivation of the vine, its protection against diseases and insect pests and progressive development and improvement of wine making promise a bright future for the export trade of Greece. The State, desiring to propagate as widely as possible viticultural and wine making knowledge, has established special sections at the School of Industries, at the College of Agriculture at Athens, which collaborates with provincial wine factories, at present few in number, and with a School of Arboriculture and Viticulture at Patras. The Roussopoulos Industrial Academy which has worked with success for several years also deals with the spread of viticultural and wine making knowledge.

Wine making establishments, formed by associations of vine growers have recently been started in addition to those of large companies established long ago. This movement will certainly have satisfactory results for the production and trade of viticultural produce of Greece.

The production of raisins is estimated to average 140 million kg. of which  $\frac{9}{10}$  are currants and  $\frac{1}{10}$  sultanas, Cretan etc. The production

of currants amounts on the average to 280 millions of *Venetian pounds* (1 *Venetian pound* = kg. 0.450); it often exceeds 300 millions and sometimes falls as low as 200 millions of pounds. The quantity exported amounts to 250-340 millions of pounds. The remainder is used in industry for making wine, spirits, and syrup. Currants are grown on an area of about 700 000 *stremmes*, the average yield from which is 400 pounds per *stremme*. The cost of cultivation, before the war, amounted to 50 *drachma* per *stremme*; reckoning interest on the average value of each *stremme*, the production of 400 pounds of currants cost 80 *drachma* or 200 *drachma* for 1000 pounds. During the years of the war the cost increased to five times as much, consequent on mobilization, dearness of sulphur, sulphate of copper, manures, wages, etc. But the price of currants also increased proportionally reaching 600-800 *drachma* per 1000 pounds during the last two years. In 1921, owing to the rise in foreign exchange, the price has reached an average of over 1800 *drachma* per 1000 pounds.

The importation of foreign currency by the sale of raisins amounted before the war to 80 million *drachma*. In 1920 and 1921 the sum imported rose to about 200 million *drachma*, and it is estimated that in 1922 the sum that will be imported by the export of this produce will be 450 million *drachma*.

Raisins are grown in Greece to a great extent by the vine-growers themselves who employ also the members of their families on this form of cultivation, so that a large portion of the wages go to them.

G. A. B.

318 - Deep Ploughing of the Soil and Its Effect on Vine Chlorosis. — ERRICHELLI, F., in *Giornale vinicolo*, Vol. LXVIII, No. 35, pp. 372-374, and No. 39, pp. 383-385. Casale Monferrato, September 17 and 24, 1922.

After a very wet autumn and winter, serious cases of vine chlorosis are often observed in the spring, especially on calcareous soils. This is due to the water, which is almost saturated with carbon dioxide, having dissolved a large amount of calcium carbonate. Owing to the coagulating power of the calcium carbonate the colloidal substances adsorb large quantities of iron salts, and the vine is deprived of the iron it requires. Similar instances have already been studied by PFEIFFER in the case of the nitrogen adsorbed by calcic zeolites. Not only is the iron thus removed, but an excess of calcium bicarbonate is formed in the soil which neutralises the acid sap of the roots which plays such an important part in plant nutrition. In addition, an alteration of the texture of the soil takes place in calcareous land and this prevents the free circulation of air.

According to the hypothesis put forward by GOLLA, iron salts are the carriers of oxygen in the plant and thus control the respiration interchanges in the tissues. When iron is not absorbed chlorosis follows as a result of root asphyxiation. The various types of *Riparia*, which have very well developed organs of respiration and transpiration, turn yellow sooner than other vines if grown on calcareous soils. The vol-

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ume of oxygen given out is larger than that contained in the carbon dioxide absorbed; this excess oxygen is furnished by the salts of the cell sap which undergo reduction (SCHLÖSING); to the same cause is probably to be attributed the yellow colour of the chlorophyll. If nascent hydrogen is bubbled through a solution of chlorophyll, the green solution changes colour until it becomes similar to that of the chlorophyll of chlorotic plants. Therefore this loss of colour is a reduction phenomenon.

In spring, owing to the rise in temperature, the adsorbent power of the soil greatly decreases, thus placing the nutrient elements at the disposal of the plants. This occurs much less in calcareous soils than in others, as owing to their slight permeability to water and gases, the ground long remains cold and ill-ventilated; this adds to the troubles due to want of iron.

On calcareous soils, deep ploughing is most beneficial, especially in preventing chlorosis. Soils that have been well-worked not only have the power of storing up more water than unploughed soils, but also encourage new reactions producing a store of heat which tends to decrease absorption and to promote the development of microorganisms. The coagulation phenomena are increased by the formation of hydrogels which impart a granular structure to the soil; further, the mineralisation of the organic matters is promoted, and the formation of organic humic acids which help in the formation of impermeable layers, is hindered. The author therefore advocates the frequent working of the soil at the proper seasons, and the application of a suitable organic fertiliser. A. de B.

## FORESTRY

1319 — **Storage of Coniferous Tree Seed.** — TILLOTSON, C. R. (Forest Examiner, Forest Service, United States Department of Agriculture), in *Journal of Agricultural Research*, Vol. XXII, No. 9, pp. 479-510, 2 fig., Washington, D. C. nov. 16, 1921.

During the period from 1909 to 1913 the United States Forest Service was especially active in its reforestation programme, for which purpose large quantities of seed were needed. In the year 1910 alone four pounds of seed were collected. A good seed crop in any region is often followed by one or more very poor crops. In consequence it is desirable to collect during good years sufficient seed to last several years. The Forest Service followed this course and was then confronted with the problem of the storage of the seed so that it would not deteriorate greatly in germinative capacity and energy before it could be used. Similar problems had already been studied in Europe, chiefly by CREAZ and by HAACK, but they were confined to four species only, three of which were European. In order to meet an immediate need for information it seemed desirable to extend them in order to include those American species most used in reforestation operations on the national forests. These species were western yellow pine (*Pinus ponderosa* Law.), western white pine (*Pinus monticola* Dougl.), white pine (*Pinus strobus* Linn.), Engelmann spruce (*Picea engelmanni* Engelm.), Douglas fir (*Pseudotsuga taxifolia* (Law.) Britton), and Lodgepole pine (*Pinus contorta* Loud.). The study should now be continued with the more sensitive

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ferous seeds, the true firs, the cedars, arborvitas, redwoods, and the erous species of American hardwoods of which so little is known. On account of the large number of variable factors involved (6 species of seed, 5 kinds of containers, 13 storage points, and 3 temperature itions at each of these points), the general conclusions are by no as fully supported by the results in every individual test. It is ght, however, that the average results are a safe criterion of what in general be expected from coniferous seed under storage condi-

Fresh seed, with the wings removed, of the species previously men- d was obtained during the autumn and winter of 1908-9 in the amounts from the sources indicated below:

*engelmanni*, 10 pounds, San Isabel National Forest, Colorado.

*monticola*, 55 pounds, Coeur d'Alene National Forest Idaho.

*centorta*, 12 pounds, Deerlodge National Forest, Montana.

*ponderosa*, 70 pounds, Boise National Forest, Idaho.

*strobilus*, 30 pounds, New York State.

*otsuea taxifolia*, 25 pounds, San Isabel National Forest, Colorado.

Each lot of seed was divided roughly into portions of about 600 to seeds each, and these were distributed equally among the following iners.

inary manila paper coin envelopes.

ially envelopes soaked in melted paraffin.

on Cloth bags.

ilar bags soaked in boiled linseed oil and dried.

ss bottles which after filling were sealed air-tight with paraffin.

seed of all six species stores in each of the five containers consti- one test set of samples. For convenience in handling, shipping, storing, each test was placed in a small wooden box lined with a wire to prevent the access of rodents.

it was one purpose of the study to determine whether seed dete- ted in storage to a greater extent in one geographical region than other. Thirteen places of storage, were then selected from widely ated parts of the United States.

Another point on which it was hoped this study would throw some was the effect of different conditions of temperature on seed in stor-

At each of the geographical points mentioned, accordingly, the rators in the study were requested to store the seed under the fol- g conditions of temperature:

1. Ordinary indoor temperature, such as an office shelf where the rature would always be above the freezing point.

2. Fluctuating temperature, as in an outbuilding or unheated t where the temperature would follow rather closely the actual out- variations. Proximity to a stable was to be avoided.

3. Fairly uniform low temperature, such as prevails in as unheat- sement or cellar.

The study was planned to cover a period of approximately five years. The seed was sent to the 13 points of storage during March, 1909, in January, 1910, and again in January, 1911, 1912, and 1914, three test sets (one stored at each of the three temperature conditions) were forwarded by express from each of the storage points to Washington, D. C. for testing.

Tests were then carried out after the seed has been in storage for one, two, three and five years. It is unlikely that seed in commercial quantities, would be stored for a longer time, but some of the seeds which had been stored in bottles were carried over for another five years and tested in 1911.

The seed-testing operation was a simple but rather large undertaking as during each of the four years 195 germination tests were made for each of the six species. Two hundred seeds were used in each test.

Ordinary green-house wooden flats were filled with fresh sand and the seed was scattered uniformly and covered with  $\frac{1}{8}$  to  $\frac{1}{4}$  inch of sand. The temperature was kept from 70° F in day time to 50° F at night. A careful daily record of the germination was kept, summarised by the data in 9 tables giving the average germination per cent. for seed stored in different containers and under different temperature conditions, and also the average germination per cent. for all 4 years at the different elevations.

The conclusions (based only on six species, and therefore not applicable to all species of coniferous seed) may be stated as follows:

- 1) Storage of coniferous seed in air-tight bottles is far superior in every respect to storage in any other container. The average germination for the 5-year period, of seed stored in bottles over that stored in the next best container was 22 per cent.
- 2) Thoroughly air-dried coniferous seed stored in air-tight bottles is little, if at all affected by such differences in temperatures as exist between a location where the temperature follows the natural fluctuations, a location indoors where the temperature never falls below freezing, and a location in a ordinary cellar or basement.
- 3) Coniferous seed stored in air-tight bottles is little, if at all affected by the geographic location of the storage point.
- 4) The quality of coniferous seed, by which is meant its value in terms of both germinative energy and germinative ability, is much superior in the case of seed stored in an air-tight bottle to that stored in any other receptacle. This is seen even at the end of one year of storage.
- 5) Following the air-tight bottle, the various containers, in the order of their merit, fall into the following sequence: paper bag paraffined, paper bag, cloth bag, and oiled cloth bag. It should be noted that an ordinary paper bag closed at the top is superior to a cloth bag for seed storage. The oiled cloth bag is practically worthless as a container.
- 6) The use of any of the containers except the air-tight bottle, results in such rapid deterioration after one or two years of storage under the temperature conditions of this experiment as to render the seed, particularly of Engelmann spruce, Douglas fir, and white pine, of very little worth.
- 7) Storage at the indoor temperature is superior to that at fluctuating or low temperatures. Storage at the low temperature shows the poorest results. This low temperature has reference not to a low uniform temperature of freezing or less but to that of an ordinary cellar or basement. The difference in germination percentage is not great.

er these three conditions but is sufficient to make indoor storage preferable to the other two conditions.

8) Some geographic locations of relatively high altitudes and of low relative humidities stand out as exceptionally favourable localities for seed storage, others are unfavourable and should be avoided where ordinary methods of storage are followed. No one of the geographic locations shows marked superiority over another when the seeds are stored in airtight bottles.

9) In respect to sustained vitality, the seeds employed in this study range themselves in the following sequence, with the strongest first: western yellow pine, lodgepole pine, western white pine, white pine, Engelmann spruce, and Douglas fir.

The striking superiority of the seeds stored in the air-tight bottles over those stored in any other container, is particularly true when the storage period extends beyond one year and is more striking in the case of Engelmann spruce, Douglas fir, and white pine than in that of lodgepole pine, western yellow, and western white pines. The seeds of the first two species are apparently more likely to deteriorate than those of the other three and after two years of storage are of little worth.

The germination of the seed before it was put in storage was at least equal to that of the seed stored in bottles at the end of one year.

At the end of five years the bottle-stored seed of all species, except western yellow pine, is practically equal or superior to that stored for one year in cloth bags, and the bottle-stored seed of western yellow pine is superior to that stored for two years in any of the other containers. Douglas fir, Engelmann spruce, and lodgepole pine seed stored in bottles, western yellow pine in oiled cloth bags, lodgepole pine in cloth bags, and western white pine in paper and paraffined paper bags show some appreciation in quality at the end of the second year over that at the end of the first; there is in general a marked and fairly uniform deterioration of seed for a 3-year period, after which it is less rapid.

Various experiments with tree seed tend to prove that storage at a uniformly low temperature (0° to 32° F.) is preferable to that at higher temperatures.

Ordinary basements and cellars for storing seed in unsealed containers are to be avoided and in northern temperate climates, storage indoors where the temperature never goes below freezing, is preferable to storage where the temperature follows the natural variations.

The bottle-stored seed in this study was not affected by climatic conditions at the points of storage. Two of the points, Dundee and Ukegan, which the study indicates were very unfavourable storage sites when ordinary methods of storage are followed, appear in the case of bottle-stored seed to be among the most favorable locations.

Some of the bottle-stored seed exposed to the air at the end of 5 years, afterwards resealed was carried over for another 5 years and tested in 1919, under the same conditions as in previous years. This part of the experiments cannot truly indicate whether seed can be successfully stored for 10 years without great deterioration, but does give an idea of the relative sustained vitality of the species concerned.

Engelmann spruce, Douglas fir, and white pine failed to germinate while Lodgepole pine germinated to the extent of 9 per cent., and completed its germination in 90 days, western yellow-pine 22 per cent. in 75 days, and western white pine 6.5 per cent. in 130 days. A. d. B.

1320 - **An Investigation into the Relation between Height Growth of Trees and Meteorological Conditions.** — HILLY, W. E. and CANLIFF, N., in *Oxford Forestry Memoirs*, No. 1, Oxford, 1922.

Preliminary investigation into the relation between height, growth of trees and meteorological conditions from data were collected in Bagley Wood, near Oxford. The height increments of a number of vigorous young trees (average height 2  $\frac{1}{2}$  metres) of different species were measured twice a week during the growing season of 1921. Some data had also been collected in 1920. These measurements were then considered in conjunction with different climatic factors, such as temperature, rainfall, sunshine, wind, etc. Special attention was paid to Sitka spruce, Corsican pine and European larch, in each case eleven trees being kept under observation. A few Douglas fir, *Pinus ponderosa*, *Abies grandis* and Japanese larch were also measured. Beech was taken as a type of broadleaved trees.

The conifers which were observed fell into three groups distinguished by the periods of growth:

- a) Corsican pine and Scots pine grow most rapidly at the end of May;
- b) Sitka spruce, Douglas fir, and *A. grandis* grow most rapidly in the latter part of June. In both these groups growth commences at the end of April and ceased in July or early August;
- c) In European and Japanese larch the whole growth was from two to four weeks later than in the other conifers, and growth was more regularly distributed over the whole period.
- d) Beech differs markedly from the conifers in that it grows very rapidly during May and only slowly during June and the early part of July.

The following table gives the maximum daily increment and the annual growth of the most vigorous tree of each species observed in 1921:

	Maximum daily increment in mm.	Annual growth in cm.
Sitka spruce. . . . .	22.0	83
Corsican pine . . . . .	13.3	43
Larch. . . . .	7.3	29
<i>Thuja plicata</i> . . . . .	4.3	16
Douglas fir . . . . .	15.3	49
Beech. . . . .	33.5	66

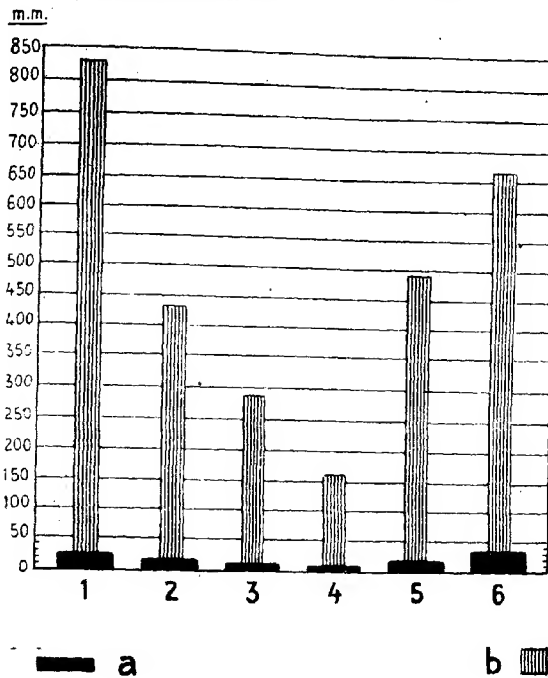
The figures for Sitka spruce and beech are about normal, for Corsican pine and Douglas fir a little low, while for larch and *Thuja plicata* they are very low. *T. plicata* showed a certain amount of growth during the winter of 1921-2, and also a small growth of the previous year's shoot during the growing season of 1921.

[1319-1320]

The effect of the hot, dry season of 1921 was both to shorten the growing season and to reduce the daily increments.

With regard to the influence of climatic factors on growth, in Corsican pine and Sitka spruce the closest relationship observed was that between

*Growth in height of same species of forest trees.*



EXPLANATION:

a = daily growth; b) = annual growth.

1 = Sitka pine; 2 = Corsican pine; 3) = larch; 4) = *Thuja plicata*; 5 = Douglas fir; 6 = beech.

the daily height increments and maximum shade temperature. It appeared that temperature was more important than all other factors put together in determining variations in the rate of growth. Larch gave a similar result when the mean shade temperature did not rise above 19°C and the water supply was sufficient as in 1920, but in 1921, when the mean shade tempera-



ture rose above 19° C there was an indication that growth was depressed.

The comparison of annual height increments of Corsican pine with temperature showed that an increase in mean air temperature during the whole growing period causes a decrease in the annual growth, whereas a rise in the mean daily temperature causes an increase in the daily increment. At present no explanation of these facts can be advanced, but it is suggestive that annual increment was found to be inversely related to mean soil temperature at 6 inches below the surface for May and June.

For good annual increment the rainfall of the growing period appeared to be more important than that of the previous winter period. G. A. B.

1321 - **Colonial Timbers and the Work of the Bordeaux Colonial Institute.** — *Annale de l'Institut Colonial de Bordeaux*, pp. 193-207. Paris-Bordeaux, July-Aug. 1922.

The object of this paper is to prove that France can satisfy her timber requirements, which increased very much after the war (about 8 million cubic m. a year), without having to depend on foreign timber, by utilizing the hitherto neglected forest resources of her Colonial possessions.

As a matter of fact the forest in French Colonies cover considerable areas as can be seen from Table I.

TABLE I. — *Forest areas in French Colonies.*

Tunisia . . . . .	500 000 ha
Algeria . . . . .	2 350 000 »
Morocco . . . . .	1 500 000 »
Ivory Coast . . . . .	12 000 000 »
Caboon . . . . .	30 000 000 »
Cameroon . . . . .	12 000 000 »
Madagascar . . . . .	39 000 000 »
Indo-China . . . . .	25 000 000 »
Guiana . . . . .	5 000 000 »

Table II gives in a rather incomplete and approximate manner the exports from French Colonies properly so-called.

Detailed examination of statistics of timber exports from certain French Colonies to countries to which they were consigned show that before the war wood was sent to France in small quantities; a large amount was sent to Germany but since the war the quantity has always been small; for example, for the exports from the Ivory Coast from 1916 to 1920 the average was 14 % to France and 86 % to foreign countries (especially the United States and England).

Since 1917, the Bordeaux Colonial Institute has investigated the best means of utilising Colonial timbers; further, it encouraged botanica and forestry research so as to obtain still better knowledge of the species of trees which form the Colonial forests and which are known, thanks to the publications of PIERRE, R. P. KLAINE, LECOMTE and CHEVALIER (regarding the Ivory Coast and Caboon), of CHEVALIER (regarding Tonkin,

TABLE II. — *Exports of wood from French Colonies from 1911 to 1920.*

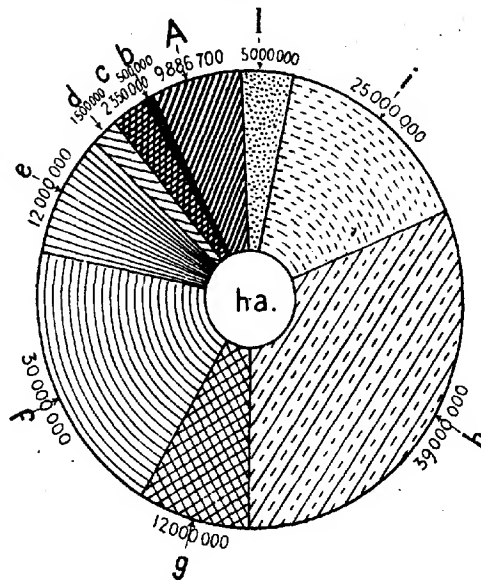
Woods	Ivory Coast	Gaboon kg.	Madagascar kg.	Indo-China kg.	Guiana steres
1911					
Common . .	—	—	3 248 168	8 143 745	7 900
Exotic . .	23 814 188 kg	102 240 000	1 116 773	524 943	20 955
1912					
Common . .	—	—	3 517 739	12 008 265	851
Exotic . .	30 489 783 kg	95 747 000	2 929 742	169 643	18 828
1913					
Common . .	—	—	1 622 540	11 700 552	23 135
Exotic . .	42 651 829 kg	150 688 000	4 857 594	160 289	308 835
1914					
Common . .	—	—	1 472 480	12 098 265	21 135
Exotic . .	41 054 563 kg	87 457 000	1 846 833	159 643	54 835
1915					
Common . .	—	—	2 558 011	—	877 597
Exotic . .	17 867 371 kg	18 762 000	948 419	6 196 000	1 083 850
1916					
Common . .	—	—	3 940 134	—	—
Exotic . .	8 133 steres	8 091 000	784 984	5 432 000	404
1917					
Common . .	—	—	2 920 023	—	—
Exotic . .	12 817 steres	4 616 000	79 049	4 793 700	558
1918					
Common . .	—	—	2 096 803	—	—
Exotic . .	37 388 steres	2 030 000	167 883	10 912 700	263
1919					
Common . .	—	—	5 359 916	—	—
Exotic . .	36 229 steres	—	564 089	8 568 700	558
1920					
Common . .	—	—	6 364 263	—	—
Exotic . .	61 682 steres	27 732 000	4 743 056	1 727 000	2 310

of LOUVEL (regarding Madagascar), of BERTIN (regarding the Ivory Coast, Cameroon, Gaboon and Guiana).

At the present time the forest trees of French Colonies are sufficiently known botanically and technically, but their exploitation presents some difficulties. To begin with, the predominance of a given tree never occurs in the Colonial forests, as it does in European and American forests, but such forests are formed of an approximately even mixture of many species, so that for profitable exploitation it would be necessary that all the different classes of trees should be utilisable:— timber for cabinet-

work, building timber, wood for paper pulp, etc. Moreover, there are serious difficulties as regards labour, especially in certain Colonies; these might be solved by temporary emigration. Lastly manufacturers and merchants must accustom themselves to make use of timbers from French Colonies

*Area of forests in French Colonies.*



A =	Area of forests in France.
b =	" " Tunisia.
c =	" " Algeria.
d =	" " Morocco.
e =	" " Ivory Coast.
f =	" " Gaboon.
g =	" " Cameroon.
h =	" " Madagascar.
i =	" " Indo-China.
I =	" " Guiana.

which can be advantageously substituted for more expensive foreign timbers.

To carry out the whole of this programme the public authorities must take wide action, helped in this matter by the various State organi-

sations and by every Colonial Government. To assist this movement, the Bordeaux Colonial Institute assembled, on the occasion of this year's fair, a Congress on Colonial timbers at which were to be discussed, by means of 11 committees all the scientific, technological, industrial, commercial, general and special questions regarding the utilization of the forest resources of the French Colonies, especially from the standpoints of the requirements of the Mother-country and of the commercial progress of the port of Bordeaux.

F. C.

1322 — **Atlas Cedar-Wood Oil.** — MASSY, in *Chimie et Industrie*, Vol. VIII, No. 2, pp. 464-465, bibliography of 11 publications. Paris, Aug. 1922.

Atlas cedar-wood oil is obtained by distilling sawdust of *Cedrus atlantica* Mariette under water. It is a clear, yellow, balsamic liquid which becomes ropy at about 280°. It has remarkable pharmaceutical properties and can advantageously be used in place of sandal-wood oil in therapeutics. A small industry was started in Algeria, near Constantine and was afterwards abandoned; but the high price reached by sandal-wood oil has caused people at present to renew research on Atlas cedar-wood oil. The cedar resources are enormous; the forests of Middle Atlas could furnish at least 600 tons of oil a year, and as the production would exceed the requirements of the pharmaceutical industry, the use of the oil in the scent and soap industry should be tested.

A. de B.

#### LIVESTOCK AND BREEDING

1323 — **Pathogenetic Consequences of Feeding Cattle on Cakes made of Cacao-Bean Shells.** — EBERHARD, in *Berliner Tierärztliche Wochenschrift*, Year XXXVIII, pp. 333-335. Berlin, July 2, 1922.

The present dearth of the commonest stock-feeds has led several cattle owners of Caymen (East Prussia) to feed animals on their farms with cakes made from the shells of the cacao-bean. In 7 farms out of 10 where this new feed had been used, the animals showed signs of intestinal irritation and of diarrhoea; in 5, cutaneous affections in the form of diffuse eczema showed themselves, while the milk yield was considerably decreased. The author does not actually assert that all the above morbid symptoms are specifically due to feeding the cattle on the shells of the cacao-bean, although the decrease in milk yield is certainly attributable to this cause, as it showed itself when these shells were fed and ceased as soon as the latter were no longer given.

E. F.

1324 — **Lupinism in Horses.** — REINHARDT, R., in *Monatshefte für praktische Tierheilkunde*, Vol. XXXIII, Nos. 4-6, pp. 174-179. Stuttgart, June 30, 1922.

Four horses that had eaten a small quantity of lupinus showed symptoms of poisoning, and three of them died after 7-8-9 days respectively.

[1321-1324]

All the animals suffered from a general disturbance of the circulatory system, had a high temperature, lost their appetite and were unable to retain urine; the mucous membrane, where it could be seen, was of a yellowish colour. In addition, each horse showed a special syndrome of symptoms. In the first animal, the nervous system was attacked (as was shown by cramp, spasmodic torticollis, trismus, and incapacity to keep on its feet); the second and third suffered from disturbances of the digestive system (colic, loss of appetite), and the fourth showed every sign of paralysis. Anatomical-pathological examination revealed serious lesions in all four horses, the liver being chiefly affected (parenchymatous hepatitis, jaundice), and petechial lesions occurred throughout all the organs.

Stress should be laid on the fact that a small quantity of unsweetened lupin seed was enough to produce such serious toxic symptoms that death was caused in three out of the four cases; further, it is noteworthy that blue lupins are as poisonous as the yellow variety. Horses appear to be much more susceptible than sheep to the toxic properties of lupin seeds; this had been already observed by several authors. The greatest caution should therefore be exercised in feeding lupins to horses; in all cases, the seeds should be sweetened and given in small quantities.

E. F.

**1325 — Johne's Disease (chronic bacterial Dysentery or Paratuberculosis of Cattle). —**

BEACH, B. A. and HASTINGS, E. G., in *Agricultural Experiment Station, University of Wisconsin, Bulletin* 313, pp. 2-22, 6 figs. Madison (Wis.) May 1922.

JOHNE'S disease is so called after the name of the discoverer of the etiological agent but it also (according to various writers and countries) bears the names of paratuberculosis, chronic bacterial dysentery, Laaland disease (Norway), "Kaltbrandigkeit" (Switzerland), Serapie (England and Scotland). It is fairly common in England, Switzerland, and Denmark where it causes considerable losses; in 1908 it was discovered for the first time in the United States (Pennsylvania) by L. PEARSON, and has at present been reported in the territories of 8 States. Animals susceptible to the disease are cattle, rarely sheep and goats; the etiological agent is JOHNE'S bacillus, which enters the bodies of cattle in their food and drink and multiplies enormously in the walls of the intestines and in the lymphatic glands nearest to them. As the disease progresses many bacilli are excreted at the same time as the dung and may thus be ingested by other animals. The clinical symptoms show themselves slowly and it appears that at least 6 months must elapse from the time of infection before it can be clinically identified. A characteristic fact is the progressive emaciation which reduces the animal to a mere skeleton; the secretion of milk becomes very much reduced and may cease entirely; the eyes become sunk in their orbits as infra-orbital fat is lacking; generally there is no fever. Another obvious symptom is the diarrhoea which appears and disappears at irregular intervals. The syndrome might be mistaken for

that of tuberculosis, but the latter is excluded by the emaciated appearance and by there being no reaction to tuberculin.

Pathological anatomy reveals injuries of relatively small importance in comparison with the extreme wasting of the animal; it might be said that the only characteristic alteration is the thickening of the intestinal wall; it may vary in extent and degree, but is more often found as far up as the ileo-caecal valve and consists in the enlargement and thickening of small folds of the intestinal wall. Moreover, in the case of the normal intestine, the folds disappear when the wall is stretched, while they do not disappear when the intestine is diseased. The data available at present tend to show that the disease is transmitted from one herd to another by bringing an infected animal into a healthy herd. This is particularly easy owing to the fact, mentioned previously, that the clinical symptoms do not appear until long after infection has commenced. Two Englishmen, Messrs. TWORT and INGRAM who have used improved methods of research for diagnosing the disease in its early stages, have succeeded in preparing a substance similar to tuberculin, both in the way it is prepared and the method of use. This substance has up to the present given good results in Europe, and is now being subjected to verification tests in America; it is obtained by the culture, on special media, for at least three months, of organisms which cause the disease. At the end of the period the cultures containing the bacilli are heated so as to kill the bacilli, and are preserved by taking special precautions.

The disease does not appear to be transmitted directly by the mother to the new-born animal; but the separation of the mother from the young animal is certainly a good precaution to prevent the latter from being placed in an environment favourable for the contraction of the disease.

E. F.

1326 - **Disease of Newly-Born Rabbits.** — NELLO, N., in *Bassa Corte, Rivista degli allevatori d'Italia*, Year III, No. 56, pp. 1252-1256. Molassana (Genoa), August 1922.

The author has made a study of a disease which attacks recently-born rabbits. The number of these animals affected with this malady during the first few days of their life is very great and the result is always fatal. About 24 hours before death a viscous saliva is seen to flow from the lips and spread over the hair covering the cheeks; the animals lose their characteristic rigidity, and the muscles of the body relax, and the coat becomes excessively glossy; somnolence and lack of response to stimuli which occur during the early stages of the disease pass into a profound coma very soon terminating in death.

An anatomo-pathological examination revealed the characteristic symptoms of diffuse septicaemia; small, slightly mobile bacteria were found in the viscera. When death ensued on the fifth, or seventh day after birth, the pathological symptoms were more localised being especially noticeable in the intestines and lungs; sometimes dead individuals were found free from all signs of general congestion and haemorrhagia, only the

[1325-1326]

intestines and neighbouring glands showing any lesions. The number of the above-mentioned bacteria in the intestines was very large, but few of these micro-organisms found their way into the other organs, or into the blood. The author attributes the disease to these bacteria which resemble the common *Bacillus coli*, and is of the opinion that the malady is spread by the milk sucked from the dam, or else by umbilical, or possibly intra-vaginal, infection. He has succeeded in banishing the disease fairly quickly by carefully disinfecting the doe-rabbit both before and after the young were born, and by special disinfection of the hutches. The use of vaccin and serum is also to be recommended, as both kinds of treatment have given the same results.

E. F.

FEEDING  
OF CATTLE

1327 - Present Cost in Germany of a Kilogram of Starch or its Equivalent in different Feeds as compared with that before the war. — PAROW, in *Zeitschrift für Spiritusindustrie*, Year XI, V, No. 39, p. 265. Berlin, September 28, 1922.

From the table given below it appears that at the present market prices ruling in Germany 1 kg. of starch or its equivalent costs least in raw potatoes, and then come in progressive order: dry potato pulp, potato flakes, maize, barley, oats.

As compared with 1912, potatoes show the minimum rise in price, then follow in progressive order: dry pulp, flakes, oats, maize, barley.

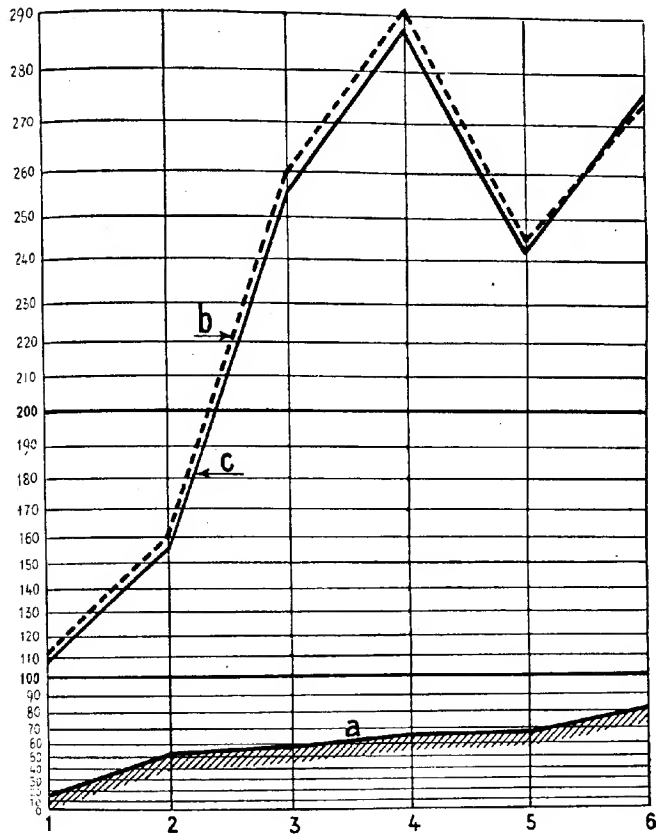
As regards the average increase in the price of feeds as compared with 1912, potatoes cost 111 times as much in September 1922, dry pulp 160 times, flakes 240 times, oats 260 times, maize 273 times and barley 291 times as much.

In comparison with oats, barley and maize, therefore, potatoes and potato products (flakes and pulp) show the least increase in price, and

Price on the German market of some feeds  
and of 1 kg. of starch equivalent furnished by them.

Feeds	KELNER Starch equivalent	Price in Marks per 100 kg.		Coefficient of Increase	Price in Marks of 1 kg. of Starch Equivalent		Coefficient of Increase
		in 1912	in 1922		in 1912	in 1922	
Potatoes . . . . .	16.9	4.5	5.0	111	0.27	29.59	109.6
Dry potato mash . . . . .	50.9	10.0	16.0	160	0.20	31.40	157.0
Oats . . . . .	59.6	18.9	49.0	260	0.32	82.22	257.0
Barley . . . . .	66.6	16.5	48.0	291	0.25	72.07	288.2
Potato flakes . . . . .	68.8	16.4	40.0	244	0.24	58.14	242.2
Maize . . . . .	80.3	18.6	50.8	273	0.23	63.26	275.0

[1326-1327]

*Starch value of feeds before and after the War.*

## EXPLANATION:

*a* = pure starch value according to KELLNER; *b* = relation between the local value in 1922 and 1913; *c* = relation between the local value in 1922 and 1913.

1 = potatoes; 2 = dry potato pulp; 3 = oats; 4 = barley; 5 = flaked potatoes; 6 = maize.



consequently in the last three feeds 1 kg. of starch value costs the least. F. D.

1328 - Comparison between Calcium Chloride and other Calcium Salts as a Stock Feed. — LOEW, O., in *Süddeutsche Landwirtschaftliche Tiernucht*, Year 17, pp. 13-15. Munich-Hanover, January 27, 1922

Calcium salts, the carbonate (chalk), and the phosphate have hitherto been fed to young stock in the form of a powder mixed with their rations, for the purpose of promoting bone development. Recent experiments have proved that the calcium salts present in the blood and muscles have other no less important functions than that of building up the skeleton, and must be regarded as factors essential to the normal working of the living organism. It is not known at present how much of the powdered calcium given to the animals is assimilated by the blood and tissues or in what percentage is absorbed by the stomach. In any case, it is necessary to administer the calcium salts in a form soluble in water and which can be easily assimilated.

The use of chalk, the calcium compound generally employed, has many drawbacks, as calcium carbonate is dissolved by the acid in the gastric juice, which acid is required for digestion and is indispensable for the digestion of albuminoid substances.

In order to produce any perceptible effect on the organism, a very large amount of chalk (50 gm.), must be ingested daily; this requires for solution 18 litres of gastric juice which is thereby completely neutralised and rendered relatively incapable of digesting the remainder of the ration. Further, the lack of gastric juice allows the numerous bacteria in the stomach to multiply freely. These statements have been proved by the results of some pig-feeding experiments in which the animals given maize, blood-meal and chalk developed more slowly than those that had received no chalk. The author is of opinion that calcium chloride is preferable to chalk, if given in much smaller quantities, as its effects are quite as beneficial and rapid as those of calcium carbonate and it has fewer drawbacks. In addition, calcium chloride is of therapeutic value in the case of certain specific diseases (diarrhoea, and sometimes in deficient bone development) whereas chalk has no such property.

Chloride of calcium is more expensive than carbonate of calcium, but is used in smaller quantities and produces a great increase in the live weight of stock, especially in the case of pigs. The results of experiments on young cows given carbonate of calcium showed an average increase in live weight of 100 kg., as against 126 kg. obtained with the chloride. In other experiments with 15 cows, the animals fed calcium chloride increased 10.1 % in live weight, while those given calcium carbonate only increased 8.5 %. If only the 6 youngest cows are taken into account, the average live weight increase was 20.5 % with calcium chloride, and 15.3 % with calcium carbonate. This shows clearly the superiority of the chloride, especially in the case of young, growing animals.

E. F.

1329 - **Hybridism in the Genesis of tame Races of Birds.** — GHIGI, A., in *Genetica, Nederlandsch Tijdschrift voor Erfelijkheid- en Afstammingsleer*, Vol. IV, No. 3-4, pp. 364-374. The Hague, May-July 1922.

The writer recapitulates the results of his experiments with poultry and pigeons, adding a few remarks on the value of hybridization in the genesis of tame races and consequently of species.

Ethical or physiological fixity is a necessary condition for taming a species or a race of birds.

Wandering and fixity seem to form a pair of antagonistic characters which perhaps, in their heredity, follow the rule of divergence.

For about twenty years the writer tried to breed, in full liberty, pheasants of the genera *Gennaeus*, *Catreus*, *Diardigallus*, *Crossoptilon*, *Chrysolophus* (that is to say those belonging to species which show least wildness in captivity) and he found that when the young birds became full grown they flew away and did not return. This was specially the case in late autumn and early spring when the seasons were changing. To this wandering is due the fact that the golden pheasant and the silver pheasant, which have bred in captivity for centuries, have not become tame.

The writer tried crossing tame guinea-fowl (*Numida meleagris*) and *N. pitlorhyncha* imported from Erythrea (erratic but monogamous in the breeding season). He thus obtained some guinea-fowl which did not scatter and which bred. In succession he got several re-crossings even when at liberty; the progeny finally flew away.

In generations succeeding the first crossing of the two species of guinea-fowl, their distinctive characters may re-appear combined in a different correlation to that persisting in the parents and even combined with intermediate characters found in  $F_1$ . In a former publication (*Ricerche sistematiche e sperimentali sulle Numidinee, Memorie della R. Accademia delle Scienze di Bologna*, 1911), the writer also indicated the intermediate characters and new correlations which distinguish the geographical breeds, considered by ornithologists as distinct species.

Regarding poultry, the writer has recorded the fertility of hybrids between several tame breeds and *Gallus sonnerati*. He got progeny with Bantam chickens of the bankiva type, with cross-bred chickens between Java and Padua chicken and with "silky blacks" (1). He also had several reciprocal recrossings between hybrids of  $F_1$  and *Gallus sonnerati*, corresponding to the formula (*sonnerati*  $\times$  bankiva)  $\times$  bankiva. On the other hand the hybrids of  $F_2$  were few in number.

Generally, all the hybrids proved equally fertile.

*Gallus sonnerati* turned out quite sedentary; in view of the absolute fertility of its hybrids with tame poultry, it is possible that this species may have participated in the production of certain races of tame poultry.

(1) See: — A. GHIGI, *Ricerche sull'incrociamiento dei Gallus sonnerati con polli domestici. Memorie della R. Acc. delle Scienze di Bologna*, 1916.

But it is impossible to say what these breeds are for the following reasons: — the  $F_2$  hybrids show a kind of general dominance of the characters of *bankiva*; re-crossings with tame poultry loses all trace of the morphological characters of *sonnerati*; re-crossings with *sonnerati* show decidedly the morphological external appearance of that species.

The hybrids of *Gallus varius* with *G. bankiva* have long been known under the name *G. temminki*. Breeding done in 1912 at the Berlin Zoological Gardens, and that done by M. HOUWINK at Meppel have proved, contrary to the general opinion, that these hybrids also are fertile, although the proportion of fertile eggs is low. Contrary to what has been verified in "sonneratic" hybrids, in hybrids with *varius* the characters of that species are dominant, and this dominance is shown also in re-crossings with *bankiva*. It is therefore possible that *Gallus varius* may also have participated in the production of tame races.

All tame breeds of poultry can be divided into 3 groups:— 1) homeosomatic breeds, in which the general form of the body and the correlation of its parts are such as are seen in various wild species; they lay white eggs — 2) heterosomatic breeds, in which the form of the body and the correlation of its parts are very different from those of wild breeds; these lay buff eggs (Cochinchina, Brama, etc.) — 3) breeds derived from crossing the first two groups.

The breeds of the first group may be considered to be descended from one or more wild species of the genus *Gallus*; those of the second group probably belong to a species differing from *Gallus gallus*, reared entirely in captivity by man.

The writer made two series of experiments regarding tame pigeons. The first relates to the possibility of reproducing *Columba livia* by means of crossing the most dissimilar pigeons (A. CHIGI, Ricerche sull'eredità nei piccioni domestici, *Mem. R. Acc. Scienze, Bologna*, 1914); the second relates to the possibility of obtaining fertile progeny by crossing a tame breed with a wild species other than *C. livia*, *C. leuconota* (A. CHIGI, Sulla fertilità degli ibridi fra *Columba leuconota* e piccioni domestici, *Rivista italiana di Ornitologia*, 1919).

The following are the conclusions arrived at by the writer with the experiments of the first group:—

1) When several tame breeds of pigeon, differing in size and anatomic characters are crossed one with another, a form intermediate between those of the parents is obtained which varies between given limits and does not correspond with *C. livia* because it is larger and the beak is shorter and thicker.

2) If among the ancestors there were no pigeons having grey plumage with black bars, such as *C. livia*, and if there were not at least two possessing factors capable of reconstituting the combination found in *C. livia*, the plumage of that species would not appear in the descendants. It is therefore possible to get opposite results according to the groups of factorial combinations possible between the plumage of the parents. This result allows of the supposition that, even in pigeons, the larger

type is not related to *livia*, but to a large insular species domesticated in former ages.

In the second series of experiments, in which the writer crossed a tame pigeon of the "gazzo di Modena" breed with a hen *Columba leuconota*, he obtained a cock hybrid which fertilised the eggs of 3 tame hen pigeons of different breeds producing several young pigeons which, in turn, bred among themselves. He also got 2 hen hybrids, one of which laid many eggs all light coloured, while the other laid no eggs.

These hybrids, and three others which did not grow up, were all alike. Their characters permit of the conclusion that many oriental breeds of tame pigeons are descendants of hybrids between *C. livia* and *C. leuconota*.

Having mated a hybrid gander, produced by a cygnoid gander (*Cynopsis cygnoides*) and a Toulouse goose, with two common geese, the writer noticed that all the eggs were fertile and produced a group (*Cynopsis* × *Anser*) × *Anser*. This result showed that "Russian fighting geese" must be descendants of fertile crossing between cygnoids and the ordinary European goose: Tula and Armsamkaya geese are of his kind.

The possibility of obtaining hybrids between species of birds belonging to different genera depends on individual conditions and not on the breed. The protoplasm of the 2 species is chemically different and when the difference is great they do not react on one another; sometimes, for reasons unknown to us, the reaction takes place and a hybrid is then produced. This latter, generally, does not mature its gametes, but occasionally, in circumstances again unknown to us, maturation takes place and then we have secured the possibility of a line representing a new species.

F. D.

1330 — **Horse-Breeding in Dalmatia and Bucovina.** — PFIFFL, in *Zeitschrift für Gestiitskunde und Pferdezucht*, Year XVII, No. 5, pp. 53-87. Hanover, May 1922

DALMATIA. — This country possesses 22 000 horses which when well-fed are wellgrown, high-spirited and very strong, but on scanty rations, as in the mountainous districts, remain undersized. They are used as pack-horses, and frequently made to carry too heavy loads. In order to improve the breed, the Government has distributed well-bred mares to the different Communes, and gives prizes for the best foals. Very satisfactory results have in this way been obtained.

The horses of the islands of Arbe and Pago are extraordinarily small, but are well-shaped with good legs.

On the plain of Sinj (Sinjsko polje, or Singer Feld), horses do better; races are held every year and games on horse-back.

In the mountainous parts of Dalmatia, the mule takes the place of the horse; the local breed of mules is small, but well-shaped and resistant.

A small-sized breed of donkeys is also in very general use.

BUCOVINA. — In order to improve the horses in this country. the Austrian Government established in 1819, the Radautz Stud-Station which

became a model of its kind. Before the War, Bucovina possessed 50 000 horses, viz., 5 per km.<sup>2</sup> and 8 per inhabitant;  $\frac{2}{3}$  of the population owned horses, and most of them possessed two animals. There were at that time: 21 000 mares, of which 5 000 were either in foal, or suckling foals — 22 000 geldings — 900 stallions — 9 000 colts and fillies. In 1819, the total number of head was 16 437, all light, strong, well-shaped animals, of distinctly Oriental type. Subsequently, Oriental stallions were used for the purpose of obtaining high-bred fast carriage and riding horses, while English sires were employed to increase the size of the breed.

The best horses are found at Alt-Fratanz, Satulmare, Radautz, Te-rebestie, Hiszestie and Neu-Itzkani. In the country districts, the animals are often ruined by being insufficiently fed and worked too young.

In Kimpoling, Seletin, Solka, Uscze-Putilla and Wisnitz as in Galicia, the Huzulen horse of Oriental type is bred. It is very thrifty and strong, and without an equal in the Carpathians. Although this horse is much in demand, there are not many special breeding dépôts. The Huzulen breed furnishes all the stallions; these animals are supplied by the Radautz Stud-Station to private individuals. The characters of the breed depend upon the hard conditions under which it is bred, and are lost after the first generation when the animals are taken down to the plain.

In 1774, a Army Remount Station was founded at Kotzmann, but was transferred to Waskoutz 9 years later.

As however a large number of brood-mares had been bought for breeding purposes at the same time that the Army remounts were purchased, the Waskoutz estate was too small to accommodate all the animals; hence in 1788, part of the estate of Radautz was acquired, and in 1792, the remaining portion. This property occupies the whole valley of Suczava and extends 120 km. from east to west up to the feet of mountains 1 600 m. high. In 1868 the management of the Dépôt and Breeding Station passed from the War Ministry to the Ministry of Agriculture. The object of Dépôt, of which the organisation is described by the author, is stallion breeding to supply the State and the private Service Stations. The animals kept are: half-blood English horses; half-blood Arabs of the heavier type, pure Arabs and Lippizas.

F. D.

1331 - **Horse Breeding in Hungary.** — MODSCHIEDLER in *Süddeutsche Landwirtschaftliche Tierzucht*, Year XVII, No. 3, pp. 25-33, figs. 6. Munich-Hanover, February 10, 1922.

One section of the Hungarian Ministry of Agriculture is concerned with horse-breeding, and manages the 4 Government Stud-Stations (Bábolna, Kisdér, Mezöhegyes and Gödöllő), which are very important institutions, as 70 000 horses are annually exported from Hungary. Every year, usually in June, the horses are sent as required to the Service Stations. In order to provide service facilities, the country was divided, in 1915, into 4 sections with 15 stations each containing a larger or smaller number of stallions. The service period lasted from February 15 to June 15, after which the stallions were sent back to the Depôts. Pri-

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vate individuals could have their mares served by the Government stations. Now-a-days, the Service fee is 2000 *crowns* plus a daily payment of 100 *crowns* for stabling. Before the War, 3000 stallions were necessary to meet the requirements of the different establishments, to-day 1000 stallions are sufficient owing to the reduction in the territory of Hungary due to the European War.

*All the breeds of horses now in Hungary* have been improved and purified by the introduction of English and Arab blood. The chief breeds are :

The Muraközer — still found in the counties of Zala and Somogy. Height 160 to 172 cm. — ugly head — small eyes — short and thick neck — strong, thick mane — short, wide withers — wide flanks, muscular shoulders — wide croup — flat hoofs — powerful forelimbs. The coat is generally light chestnut, but it is sometimes of other colours, dark bay, or dappled with white.

The Pinkasöer — very widely kept in the counties of Was, Moson and Sopron — Height 165 cm. — shape of head somewhat ugly — neck muscular — mane and hair of head thick — withers short — shoulders straight — chest and croup wide — very tractable. The coat is light or dark chestnut. This breed produces excellent horses for the plough and for draught purposes. It has been so much improved that no really pure-blood animals now exist.

The so-called "peasant horse" which has not been improved — height 165 cm. — head large in proportion to the body — back of average length — neck long — croup too long and narrow — good, but not very wide, chest — fore-feet sound — hind feet weak. Coat colour as a whole red. This animal has not a prepossessing appearance, but its resistance to fatigue and its thriftiness make it very useful for field-work on large agricultural farms.

The improved "peasants' horse" — height 165 cm. — the head, neck and chest are better formed ; the shape of the croup is shorter and broader, but the breed is still in course of being improved ; the most noticeable effects in this direction are to be observed in the south.

The so-called Erdely or Siebenburg horse is the result of a cross between the old Siebenburg breed and horses of Spanish blood. This animal is totally different from the peasants' horse : shape elegant — head small and pretty — shoulders strong and short — legs good and strong. These qualities combined with its health and vigour make this horse very valuable and it is in great demand.

The Mokany horse is characterised by its conformation and is small and muscular with a wiry mane and tail. This breed is characteristic of the mountainous districts of the *comitats* of Máramaros and Ugocsa, and is found nowhere else.

The author mentions the following breeds of horses which are now being reared in different Stations in Hungary. — The Arab horse. This horse began to be bred in Hungary in 1506, the year in which the Bábolna Station became Government property. The stud which has been increased

by successive purchases now boasts of three stallions and 40 mares for the breeding of half-bloods.

The Lippiza horse has been bred since 1568 and is descended from the pure-bred horses reared by the Austrian Court. It is a good horse for riding and driving purposes and makes an excellent army mount. It is also most useful in mountainous countries. Its height is 166 to 167 cm, head finely shaped — neck strong and well-formed — mane thick — withers somewhat low — back long, broad and deep — croup rounded — chest wide — feet short, strong and muscular — coat white. These horses are slow in developing; the foals are weaned at the 5<sup>th</sup> month and need much training in the riding-school. The breeding centre has now been transferred to Bábolna.

The so-called "quiet" horse is bred at Bábolna and is used for ploughing; it is long-lived and its coat is usually bay. Breeding country horses was started in 1859 at Kisbér, with Percherons imported from France and replaced later by horses from the Ardennes.

The breeding of pure-blood and half-blood English horses was started at Kisbér in 1853 with pure-bred English stock and Arab mares from Bábolna. The Station now possesses 5 pure-bred English stallions and 13 brood-mares. The foals are trained for racing from their second year, and subsequently sold by auction, the Government reserving to itself the prior right of purchasing any foals it requires. The buyer of these foals is pledged to use them for racing and never to sell them out of the country. All these foals are suckled by their dams for 6 months; from the third week, they are given as a supplementary food, oats of the best quality. They are accustomed to take cows' milk in order to avoid any digestive troubles due to an oat diet should the health of the dam not be good enough to suckle the foals the whole time. The pure-bred animals are characterised by a powerful frame and strong muscles.

The Kisbér Station for breeding half-bloods has been engaged in this work since 1870, and now possesses 6 stallions and 168 brood-mares, most of them valuable animals, as the sires used for about 6 generations have all been pure-bred. The hybrids are somewhat too light and delicate, but these defects are easily remedied by mating the mares with Arab stallions. The Kisbér horses make excellent racers and carriage horses, for they are both fast and strong.

The Nonius horse which has been bred for some 35 years at Mezöhegyes, takes its name from its progenitor *Nonius*, an Anglo-Normand stallion with much English blood in its veins. The progeny of *Nonius* and his son (which numbered 6000 in 1895) are the results of crossing these stallions with mares of all breeds. Although not handsomely formed these hybrids are very strong and vigorous, being the strongest high-spirited horses in Hungary. The small type of Nonius is robust; its height is 158 cm. The large type is strong, and lean, its coat is bay, and its height 192 cm. The Nonius breed is crossed with pure-bred English horses to improve its conformation and eliminate certain defects. The crossing must however not be too often repeated, for some of these defects

are characteristic of the breed and it is easy to obtain too light animals. Both types provide excellent horses for the plough, and for riding and draught purposes.

The Gidran breed is descended from an Arab stallion of pure type belonging to the Bábolna Station. This animal was first mated with mares of every breed, but was afterwards only allowed to serve English mares. The progeny thus obtained was of 2 types: one was very similar to the Gidran, the Arab characters predominating over the English, whereas in the second, the English characters were the more developed. The first type is more suitable for a carriage-horse, and the second for riding. As a rule these horses still show traces of their Arab ancestry. The present Gidran breed is characterised by its chestnut coat with golden lights, a white star in the forehead and fine action. E. F.

1332 - The Importance of Breeding heavy Draught Horses in Westphalia. — LENTER, in *Deutsche Landwirtschaftliche Tierzucht*, Year 27, No. 11, pp. 107-110, figs. 5. Hanover, March 17, 1922.

In spite of the increasing use of machinery in agriculture and industry, horses are still very necessary, and the demand for them has not decreased as was anticipated in some quarters, but has rather increased. Before the War, the number of heavy horses required in Germany far exceeded the supply, and many were imported from abroad. The War took a heavy toll of the horses in all the belligerent countries, and only time can make good the losses suffered, but there is at present no actual shortage and the time is not far distant when the home supply will be all sufficient.

There is at present in Germany a great demand for heavy cart horses, owing to the intensive agricultural development of the country. It is necessary on the modern agricultural farm to have horses capable of drawing heavy loads for long distances, and sufficiently docile to be easily managed by an inexperienced staff. This has led to the substitution of heavy cart horses of the Belgian-Rhenish type for the half-bloods hitherto employed. This new departure has become so noticeable of recent years in Westphalia that an observer is inclined to inquire into the causes that have brought about so radical a change in the views of the horse-breeder. In order to understand the change it is necessary to know some of the special characters of the heavy cart horse. This type can stand much hard work and costs relatively little to rear; its quiet disposition fits it also for every kind of work. It has however certain drawbacks that counterbalance these good qualities; it is a large eater, and slow worker; it is also more short-lived and less fertile than the pure-bred horse and much less resistant to disease.

One of the causes of the substitution of the heavy draught for the pure-bred horse, a change carried out in a few years, is that the type of thorough-bred produced by the breeders did not suit the general farmer. On the other hand it is true that heavy draught horses have now been introduced even where a light quick type would be more suitable.

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In the author's opinion, breeders ought to change the type of their products and replace the pure-bred light horse by the half-bred, a thrifty animal with strong skeleton, and really fitted for agricultural work. Breeding heavy draught-horses necessitates intensive cultivation and the raising of forage plants capable of developing the massive frame of the breed. This horse will chiefly be reared where the fertility and character of the soil are most suited to the production of such forage crops.

The results obtained in modern breeding stations have shown that great importance must be attributed to ancestral qualities. The author mentions some especially famous stallions and emphasizes the fact that, if satisfactory results are to be expected, it is necessary to choose a sire of exceptional prepotency. The breeders' task therefore consists in collecting the best representatives of the best lines and taking proper precautions to avoid obtaining draught horses of too light a build which have lost the characters of their type, as is the case with many of those now reared in Westphalia.

F. F.

1333 - **Development of Cattle Breeding in the Palatinate: the Simmenthal Breed and the Place it Occupies in the Agriculture of the District.** — GÜNTHER in *Süddeutsche Landwirtschaftliche Tierzucht*, Year 17, No. 9, pp. 97-100. Munich-Hanover, May 5, 1922.

Statistics are available covering about a hundred years for Simmenthal cattle, breeding in the Palatinate. The importation of these animals from Switzerland was begun in 1780, and developed so quickly that in 1898, there were already 11 Simmenthal Breeding Societies. In the Swiss mountains, these cattle are either turned out to grass or stall-fed. The general cattle rearing conditions in the Palatinate are excellent owing to the climate, extensive plains, density of population and the development of agriculture. In the southern part of the district near Pirmasens and Zweibrücker the Simmenthal and Glan breeds are chiefly kept; towards the northwest and centre, native races are preferred, but Simmenthals are common in the north, where there are many breeding Societies.

Good Simmenthal cows were frequently imported from the Grand Duchy of Baden, and from Switzerland but did not prove prolific. High prices had to be paid for imported cows which did not turn out satisfactorily, though cattle bred in the country gave excellent results. Some of these cows fed chiefly on mangels weigh about 650 kg. and their average annual yield is about 3650 litres of milk containing 3.85 % of butter-fat.

On the small farms of the Lower Palatinate (Vorderpfalz) where the economic conditions are against the use of horses for agricultural work, Simmenthal cows and only occasionally oxen are used in the fields in preference to pure-bred or cross-bred native cattle. The author has obtained from two farms the data necessary for estimating the cost of keeping a Simmenthal animal. On the first farm, the feeding cost, taking into account the price of forage and grazing expenses, was 2531 marks for the first year, 1657 marks for the second, and 1053 marks for the first 6 months of the third year. The total general outlay amounted to 2041 marks. When

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three years old, the cow weighed 420 kg., and its calf when sent to the butcher weighed 35 kg. and fetched 460 marks (1400 per quintal) as against 5460 marks (1300 marks per quintal) paid for the cow. On subtracting the latter sum from the maintenance cost (7282 marks), it is seen that the transaction ended in a deficit of 1832 marks, so that it does not pay to use expensive feeds. Further, the average weighings of several animals belonging to a Breeding Society show that a cow 25 months old should weigh 613 kg. which is much in excess of the weight (420 kg.) of the animals reared on the above-mentioned farm, although they had reached the age of 2 ½ years. It may therefore be concluded that the feeding in the latter case was unsatisfactory and did not allow a normal growth.

The maintenance expenses of a Simmenthal animal on another farm were 1575 marks the first year and 2406 marks the second; the general cost amounted to 1902 marks. The total outlay was 6153 marks, the live-weight of the cow was 560 kg. and the price which it fetched (at 1300 marks per quintal) was 7250 marks. Thus there was a profit of 1097 marks due principally to the quality and extent of the grazing grounds which shows that under certain conditions a considerable profit can be made out of Simmenthal cattle.

The author considers that these cattle should be kept on farms where the ratio of pasture to arable land is 1 : 2 and where good returns are obtained from the crops. Under such conditions a fair profit can be obtained, but otherwise breeding Simmenthals may lead to a heavy loss.

E. F.

1334 - The Advisability of continuing to Breed dual Purpose Cattle in Bavaria. —

STOCKKLAUSNER in *Deutsche Landwirtschaftliche Tierzucht*, Year XXVI, No. 7. pp. 66-68. Hanover, February 17, 1922.

For the prosperity and development of any branch of stock-breeding it is necessary that the breeders should know and formulate clearly their objects; these are determined by the physical and agricultural conditions of the country and the local requirements of the farmers. Bavarian cattle with the exception of the brown-grey mountain breed, are bred for meat, milk and work. Cattle-breeders have only recently considered the question of rearing single purpose dairy cows, in order to improve the yield and increase the fat content of the milk. The advocates of this new departure wish to regard the cow essentially as a milk producer and leave completely out of account its possibilities as a working animal. It is true that on many Bavarian farms the cows are not yoked and therefore the advantage of altering the present breeding methods is not very apparent.

Bavaria is a country of small holdings and it may be estimated that ⅓ of the total number of milch cows are employed in field work, which much reduces the cost of cattle breeding and sets off the high cost of keeping the animals. Work has the effect of decreasing the milk yield, but the value of the labour largely compensates for the deficiency in the milk obtained. Oxen are also used for agricultural work and to a much greater extent than horses. They cost less to keep than horses, for they graze during

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the intervals of work and do not suffer from the lack of nourishing food. When there is little work to be done, the ox can be kept on a much smaller amount of food than the horse and can finally be fattened and sold as a valuable butcher's beast. The loss of time entailed by the slow work of the ox is of no consequence on small and average farms where the 8 hours day has not been adopted, and the owners have large families. It is also necessary to consider the possibility of breeding at the present day and with the feeds now available, a race of dairy cows. This involves a diet containing much albumen and therefore very expensive. Hitherto the basal rations of the milch cow in Bavaria, except in the mountain and pre-Alpine regions, have been the products grown in the cultivated fields, and whereas near the mountains, the pastures and meadows supply 75 % of the food required for cattle breeding, in the remainder of Bavaria only 17 % can be obtained from these sources. In summer, the cattle are fed clover and lucerne, and in the winter they must be given mangels and straw, as there is not enough meadow hay available. These rations, for instance, 8 kg. hay, 4 kg. straw and 15 kg. mangels, barely suffice for the production of 2 ½ kg. of milk and must be supplemented on dairy farms by a fairly large amount of food rich in albumen. This difficulty can be avoided by keeping the cows at grass for at least six months, so that they can accumulate a sufficient reserve to enable them to tide over the period during which their rations contain little albumen. Arrangements could also be made for the cows to calve in the early spring, in order to make the lactation and grazing periods coincide. Another means of increasing the supply of albumen would be to grow larger quantities of albuminous plants for cattle feed. Cereals are not suitable for this purpose as their albumen content is only 6 to 10 %; horse-beans are rich in albumen (20 %) and should be cultivated wherever the nature of the soil permits. The small quantities of these beans which are grown everywhere can be turned to good account.

It is not however possible, even by feeding beans, to increase the amount of albumen in the ration sufficiently to give any considerable increase in the milk production. The quantity thus obtained will never exceed the average. It is not advisable to give cows lupins, for if these are fed to any extent, they have a deleterious effect upon the quality of the milk and butter and may also disagree with the animals.

For all these reasons the author concludes that it is not possible on most Bavarian agricultural farms to alter the breeding methods and only aim at milk production. Although it is necessary to try by every available means to increase the milk yield, the working qualities of the cattle must not be left out of account. It is only on certain industrial farms, where the cows are not used for agricultural work and the conditions are such as to insure a supply of food rich in albuminoids, that milk production can be the sole object of the breeder and every means employed to increase the milk yield.

E. F.

1335 - Experiments on Cattle Feeding, in the United States Experimental Stations. — SMITH, W. H. (University of Illinois), in *The Breeder's Gazette*, Vol. LXXXI, No. 3, pp. 71-72, 2 figs. Chicago, January 19, 1922.

During the last two years United States breeders have suffered heavy losses in cattle breeding, the total of these losses being ascertained from information collected at the Experimental Stations. From experiments made in 1919-1920 by Experimental Stations in the States of Nebraska, Wisconsin, Missouri, Indiana and Pennsylvania, which reared 26 lots of 256 calves, a net loss of about 150 fr. per head may be inferred; similar results were obtained last season: 28 lots containing 247 beasts belonging to the Experimental Stations of the States of Nebraska, Iowa, Indiana, Minnesota and Pennsylvania showed a loss of about 132 fr. per head.

Breeders, remembering that during recent years rations containing a large percentage of maize silage, with or without a few grains of maize, had given better, or at any rate not worse results, applied to experts to know what quantity of maize should be added to the rations. To determine this quantity exactly experiments were conducted at several Experimental Stations. At the end of 1920 at the Stations of Nebraska, Indiana and Minnesota, rations containing no maize were fed to one lot of steers and it was ascertained that in every case the rations without maize gave the heaviest losses, while those with much maize, or of maize only, gave the smallest losses. These results taught the farmers not to rely on the results of previous years and thus adopt rations which might have been good in time of war, that is to say, when economic conditions were very different, but owing to present prices, were no longer profitable.

F. G. KING (of the Indiana Station) notes, in examining the data for a period of 5 years, that the highest profits were always obtained by feeding with maize only. It was not until 1919-20 that the use of silage foods showed greater profits while the use of rations composed partly of silage foods and partly of maize was never profitable. After ascertaining that the most profitable ration is that composed entirely of maize an attempt was made to determine how and when the nitrogen supplement should be given. At the Minnesota and Nebraska Stations, the supplement was given in the form of linseed meal cake, but at both it was noted that the loss was more or less increased. At the Indiana Station cotton meal cake was used with better results and the loss decreased by about 12 fr. per head. The experimentors at the Pennsylvania Station state that a nitrogen supplement is to be recommended and they tried to find out whether linseed meal cake or cotton meal cake was preferable. Linseed meal cake being laxative is more suitable for the steers, but it is better to use the cotton meal cake when the ration is largely composed of silage foods. The Stations have also made experiments with substitutes for cereals, introduced during the war, the use of which tends to be continued on account of the high cost of cereals. They have ascertained that the use of barley with molasses instead of maize has never given satisfactory results.

E. F.

1336 - **The Milch Cow in Italian Agriculture.** — I. ALPE, V., La vacca da latte nell'agricoltura italiana, in *L'Italia agricola*, Year LIX, No. 9, pp. 281-284. Piacenza, September 15, 1922. — II. MORESCHI, B., L'opera di miglioramento delle razze italiane dai primi tentativi alle più recenti affermazioni, *Ibid.*, pp. 285-290. — III. GUARDASOLI, M., Il controllo del latte alla stalla in rapporto alla selezione del bestiame lattifero, *Ibid.*, pp. 291-300. — IV. VEZZANI, V., La vacca Schwitz, *Ibid.*, pp. 301-312. — V. PARENTI, F., L'importazione e l'avvenire dei bovini olandesi da latte in Italia, *Ibid.*, pp. 313-326. — VI. ZAGO, R., Ricordi zootecnici e impressioni di viaggio nei paesi d'origine del bestiame da latte, *Ibid.*, pp. 327-334. — VII. JOSA, G., Un esperimento di monticazione di bovini svizzeri di razza bruna nell'Appennino meridionale, *Ibid.*, pp. 325-338.

I. — Prof. ALPE draws attention to the importance of the milch cow in the improvement of Italian agriculture during the last 40 years and shows how correct GAETANO CANTONI'S formula is: meadow-live-stock-manure-corn, which he completes by a 5th term: chemical fertilisers.

The greater production of forage-grasses, which results from the more extended use of chemical fertilisers, gave rise to attempts to introduce breeds preeminent as store cattle, such as the Shorthorn, which several farmers of high repute have imported in the districts of Piacenza, Pavia, and Modena, and the "Modenese", introduced in the district of Vicenza, but little remains of these attempts, whereas the milch cow has become the rule everywhere. The consumption and demand for milk and milk products is continually on the increase in Italy, and the introduction of cream separators (tried for the first time in Italy by CANTONI in 1879 on the farm of the Royal High School of Agriculture at Milan), by making it possible to manufacture dry cheeses has also increased the total output of cheese.

Stock from which to breed and improve the milch cow is not lacking in Italy: the Alpine valleys, the Valteline, the districts of Brescia, Bergamo and Cremona can supply highly appreciated bulls of the brown Alpine breed; Sardinia (1) can supply the South of Italy with them.

As regards feeding, the farmers, thanks chiefly to the Agricultural Supply Associations, have excellent concentrated feeds at their disposal. In connection with labour, the Zootechnical School and the Cheese Factory at Reggio Emilia supply excellent stockmen, the travelling Agricultural Professorships also enable courses of professional instruction to be held for the peasants.

Co-operation, and especially Dairy Associations, have lent great assistance in several districts towards developing the dairy industry, both by raising the price of milk and by encouraging the farmers to improve the animals in every way. Among the new forms of Association may be mentioned the "Società di caricatori d'alpe" (Grazing Associations) and the "Casera" (Cheese Preserving Dépôt), established by the Reggio Emilia Mutual Aid Establishment, where cheeses belonging to the numerous small producers of "grana" are stored and very carefully preserved, these pro-

(1) See R. Dec. 1921, No. 1250. (Ed.)

ducers receiving a substantial advance on the price of their merchandise, which they can thus sell without "corners" being made.

II. — Before the war 38 million hectolitres of milk per year were produced in Italy. This quantity has now once more been nearly reached and will soon be exceeded. Of this quantity, cow's milk constitutes  $\frac{4}{5}$  and the rest is ewe's and goat's milk. The dairy industry deals with  $\frac{3}{5}$  of the milk produced. In 1914 Italy exported a total of 80 million liras' worth of butter and cheese, which sum might now be equivalent to about half a "milliard" liras. The continual demand and importation of dairy cows, especially from Switzerland, is thus explained.

Of the two Swiss breeds (pied and brown) the brown is the most numerous in Italy; the cattle of the valleys of Lombardy, Piedmont and the Trentino are of this breed; it is found in the eastern districts and down in the plains which can be irrigated, where it supplies the flourishing milk industry. This breed has been successfully introduced not only in all the northern provinces of Italy, but also in the south and in the islands, for instance, in Molise, Calabria, Sicily and Sardinia.

The Simmenthal breed has spread to the Piedmontese valleys of Aosta and Oropa (Biella) and especially in Middle and Lower Frioul (1); in comparison with the brown Swiss breed, it is more sensitive to climatic conditions.

Several attempts have been made to introduce other breeds: the Danish in the Province of Treviso; the Breton in those of Brescia and Aquila, and the Jersey and Guernsey in Latium (2), but with little success. In the cool valleys of the Abruzzi the Breton race has developed and gives milk exceptionally rich in fat: 5.5 %.

An attempt has been made to introduce Dutch cows (of the Friesian breed) first in Piedmont and the Province of Piacenza, where the attempt did not succeed, but it was continued on a large scale in the district of Cremona. It has been observed that the Dutch breed cannot thrive where grass is not available all the year round, but as soon as this difficulty is overcome, it gives excellent results.

Another breed which has been imported is the Savoyard or Tarentese, greatly resembling the Swiss breeds. It is found on the eastern slopes of the Alps between France and Italy; the finest and most numerous specimens are found in the Province of Turin and in the mountainous part of the Susa and Pignerol districts, the periodical importation of selected breeding bulls from Savoy prevents the breed from degenerating.

The cattle from the Reggio and Modena districts, the Pisa cow and perhaps the cattle of Modica (Sicily) are among the Italian breeds preferred for milk production.

Those of the Reggio and Parma districts greatly resemble the Bernese, which are successfully used for their improvement. The Modena breed is actually of very mixed origin whence, in the neighbourhood of

(1) See *R.* 1921, Nos. 318 and 742. (*Ed.*)

(2) See *R.* 1916, No. 777. (*Ed.*)

Modena, come those which are strictly milch breeds and possess several characteristics peculiar to the Simmenthal cattle, with the exception of the coat, which remains whitish. The Modica breed cannot be termed a milch breed, though it includes individuals which are rather good milk producers.

As, generally speaking, the Italian cattle of Asiatic, Podolian or Hungarian origin, give a low and sometimes altogether insufficient supply of milk, it is better in breeding to keep the imported milch breeds pure, leaving work and meat production to the local breeds. At the same time crossing between the imported and the local breeds is very common.

Attempts have been made in Italy to cross the Schwitz bull with the Dutch cow (and vice-versa), and the Shorthorn bull with the Swiss brown cow. In the first case the result is half-breeds with a coat almost uniformly black, good for milk production, especially if the sire is Dutch, which also show a tendency to fatten well. In the second case, the improvement is only in the meat. No specimen of the Shorthorn dairy breed has yet been introduced into Italy. MORESCHI states that excellent results would be obtained by crossing the Shorthorn dairy breed with the Dutch.

There is a similarity between the "record" yields of the Dutch breed and those of the Swiss brown: the Royal Practical School of Agriculture at Brescia has a cow, of which the writer gives a photograph, which, for a whole month, yielded on an average 42.5 litres of milk per day.

In Sicily the utility of crossing the local cattle with the Schwitz bull has been proved, but its practical adoption is rendered difficult by the lack of forage; in Sicily, breeding improvement is primarily a question of forage production.

III. — An examination of the bulls to be approved for service can only be based on external features where there is no check on milk production; it is therefore not very reliable. The writer shows from the example of several countries the valuable results obtained by the organisation of this check on the increase of general milk production; he quotes British Columbia as an example of good organisation; and he finally explains how, in his opinion, this check should be carried out in Italy. The Breeders' Association of Cremona has taken the initiative in this direction.

IV. — The number of Schwitz cattle in Italy far exceeds that of cattle of the same breed in Switzerland, including the lighter-coloured types of the Grisons and the Canton of Tessin (about 40%). In 1911, after the census, there were 545 588 head of brown cattle in Switzerland; the censuses of 1916 and 1918 do not distinguish between breeds, but they show that the number has not greatly changed. According to the Italian census of April 7, 1918, there were 1 215 695 cattle in Lombardy alone, of which  $\frac{2}{3}$ , and perhaps still more, belonged to the Alpine type more or less improved by the Schwitz breed, or the Schwitz pure breeds.

In Italy, a good Swiss brown cow when fed according to scientific methods gives on an average 3 000 litres of milk yearly, containing 3.75 to 4% of fat; 4 000 litres is often reached, and exceptionally good animals exceed 5 000 litres.

Prof. VEZZANI shows the advantage of establishing in Italy distributing centres for this breed for the improvement of stock, such centres have already begun to be formed, especially in the Provinces of Cremona, Milan, and Brescia, and Bergamo and Sondrio.

The brown breed is eminently cosmopolitan.

The Swiss cow living in the valley of the Po is apt to change the colour of its coat, either towards white or light yellow. The writer thinks no great importance should be attributed to this variation in colour. Some Italian breeders indeed think that the Modenese and Piedmontese breeds, so appreciated for their three-fold qualities, spring from distant brown Alpine forbears, which change their dark coat for the present light yellow colour, grey or white.

By selecting breeding stock in the ordinary way, a point has been arrived at in the Cremona district at which, it appears, productivity tends to remain fairly constant. To intensify it there are two methods: 1) by means of milk records and the selection of bulls on the basis of the production of calving cows and their descendants; 2) by importing a better milk-producing breed, *e. g.* the Dutch. Thanks to the initiative of the Chair of Agriculture at Cremona, these two methods have been followed. The writer, without denying the possible advantage of adopting other breeds in certain well-watered districts, thinks that cattle-breeding in Italy should be based, on the whole, on the Schwitz breed, after selection and improvement.

The Expert, FRANCIS ZANELLI, of Cremona, observing that breeding should have been advantageous where there is no fear of a shortage of grass, for instance in the "marcite" of Lombardy, recognised the advantage, as early as 1872, of the importation of Dutch cows. The first importation was made in 1875 for the Farm of the Cheesemaking and Breeding School in Reggio-Emilia, of which Prof. ANTONIO ZANELLI was at that time Director, who alluded to the possibility of acclimatising, provided cool, well-ventilated stalls were erected, — the feeding requirements and adaptation to the Italian fodder — regularity of breeding functions — the long duration of milk-secretion, which never ceases before the 40 days preceding calving — the high total yield — longevity — and the retention of the adaptability for milk-production by the descendants.

The importation of Dutch cows into Piedmont began in 1882; it afterwards continued without interruption until 1914, and recommenced intensively in 1921. Dutch cows have been introduced into several districts of Italy, and even into Sicily, but especially in the Province of Piacenza. Some establishments have been breeding Dutch cattle for about 40 years, and the fact that they form a large proportion of the clientèle for recent or imminent future acquisitions leaves no doubt as to the possibility of the adaptability of the Dutch cow in this Province.

Dutch cattle (1) belong to three distinct breeds, which are classed by the "Het Nederlandsche Rundvee Stamboek" Association as follows:

(1) See *R. May-June 1922*, No. 606. (*Ed.*)



1) Pied black, from Frisia and North Holland; 2) Pied red, from the Yssel, the Moselle and the Rhine; 3) white-headed variety from Groningen.

The numerous Breeders' Syndicates are united in two large Societies, each of which has a pedigree book: The General Dutch Cattle Pedigree Book Society ("Het Nederlandsche Rundvee-Stamboek") and the Frisian Cattle Pedigree Book Society. The former has its headquarters at the Hague, and its operations for the improvement of the three breeds above-mentioned, as well as for that of heavy draught-horses, extend over the whole of Holland. It numbers at present 9942 members with an entry of 60,000 cattle. The second has its headquarters at Leeuwarden; its operations only cover the Frisian Province and are not concerned with pied black pedigree cattle born and reared on the farms in its own district; founded in 1879, it has obtained the most important results in the improvement of the local breed.

The writer describes the organisation of the control of milk production and of prize shows and also the keeping of pedigree books, which he extols as models; and points to their efficacy in the progressive improvement of production, both as regards quantity and quality of milk.

In the breeding of Dutch cattle in Italy, there is no doubt on two points: 1) the better adaptability of animals born in Italy; 2) the great success of the results of crossing the Dutch bull with local cows of the brown type, from the point of view of milk production, adaptability and vigour. The writer therefore in agreement with Prof. DE-CARLOS, Director of the Travelling School of Agriculture in the Province of Cremona, strongly advises the introduction of the Dutch bull, of good registered milch origin, into the stables of milch cows of the Swiss brown type, with the exception of those of the latter (a small number) where the brown type is bred especially with a view to the production of pure-bred selected breeding animals.

VI. — Prof. ZAGO alludes to his journeys to Switzerland and Holland to purchase cattle; he gives a survey of the organisation of breeding and fairs in Switzerland, and of the Dutch Societies for the Control of Milk Production and the keeping of the Pedigree Stock Book.

In connection with the Swiss brown cattle, he observes that, owing to the wide diffusion of late years of the improved cattle of the Schwitz canton in the other cantons, the type is now unique, having undergone fundamental changes and improvements, so that the primitive local sub-breeds have disappeared and the predominant type is that which has always been bred in Schwitz.

The animals which have been awarded prizes in the Prize Shows cannot be exported as they are retained by the Swiss Breeding Syndicates.

VII. — The Southern Apennines have a cool climate, good cultivated forage plants and possibilities of pasturage; it is therefore advantageous to replace the present cattle (of the Podolian type, chiefly adapted to work) by the milch-cattle of the Swiss brown breed. It has already been proved in practice that substitute crossing gives good results; but for cattle of the Swiss type to succeed, pasture is indispensable; now, it is asserted by several that the Southern Apennines do not afford pasture

suitable for grazing owing to the continual periods of drought to which it is subject, even at great elevations. The Travelling School of Agriculture of the Province of Campobasso, of which Prof. Iosa is the Director, has, for purposes of demonstration, made an experiment in grazing in the district of Matese, at a height of between 1400 and 1550 metres, keeping Swiss brown pure-bred heifers there from May 22 to Oct. 11, without other food than the open pasture, the animals being kept at night in an open enclosure.

The results were extremely satisfactory. The increase in live weight per head, for the 4 months' grazing, varied from 84 to 111 kg. with an average of 94 kg. The increases in the principal body dimensions were as follows: height of withers: maximum 13 cm., minimum 7 cm., average 10 cm. — length of body, respectively: 20 cm., 6 cm., 12.5 cm. — perimeter of thorax: 33 cm., 15 cm., 23.4 cm. From the economic point of view also, mountain grazing is very advantageous. F. D.

1337 - **Dairy Cow Breeding and Milk Production in Holland, especially as regards the Dutch Frisian Breed.** — MODSCHIEDLER, in *Deutsche Landwirtschaftliche Tierzucht*, Year XXIV, Nos. 9-10, pp. 87-91 and 99-101, figs. 9. Hanover, March 10, 1922.

The indigenous breeds of cattle in Holland are dissimilar in conformation and are employed for very different purposes.

A. — The Groningen breed is native to the Province of the same name, but is now being gradually replaced by the black and white pied Frisian race. Groningen cattle are preponderant only on the Upper Rhine and west of Utrecht as far as Alfen; they are numerically much inferior to both the other breeds. A white-headed and a pied variety of Groningen cattle may be distinguished.

a) The white headed variety of Groningen cattle is stronger and heavier than the pied; these animals fatten very well. They are entirely black except for the head, belly, lower portion of the chest, the teats and the switch of the tail which are white. The head is fine and wide, the horns are slender, the barrel is rounded and the back well-developed. Although this is eminently a beef-breed, the udders of the cows are well shaped, so that milk yield is large. The live weight of the cows varies between 600 and 650 kg., their dressing yield is about 55 %. The milk yield is about 3700 kg. annually with a fat content of 3 %. These animals are chiefly bred in South Holland and in the neighbourhood of Groningen.

b) The pied variety of Groningen cattle has irregular black and white patches on the body. The average annual milk yield is about 3750 kg.; the live-weight of the cows when adult is about 525 kg.; two-year old bulls weigh as much as 625 kg. This variety is bred to the north of Groningen and south of the Ems canal.

B. — The Pied Red Breed is reared for milk and beef. It is the smallest of the Dutch breeds (1.25 m.-1.30 m. in height at the withers). These animals are generally red with the exception of the lower part of the chest and the belly, the lower portion of the legs and the front of the head, all of which are white. The head is coarse, the hide thin and fine, and the

chest deep, the horns are of medium length, white for most of their length, but yellow at the base and dark at the tip, the chest is deep, the legs are short, but well set. The live-weight is about 500 kg. and the cows yield annually about 3800 kg. of milk with 3 % of butter fat.

C. — The Pied Dutch-Frisian Breed is found in Frisia and in the North and South of Holland. It is a typical dairy-breed and widely kept, being characterised by its very high yield of rich milk.

These cattle have a long massive body, their live weight averages 525 kg. Three varieties can be distinguished :

a) The Frisian variety, of which the breeding centre is Frisia; it is white or pied-black, the latter colouring being preferred. The animals have a head of medium length, black with a small white patch between the horns, the neck and saddle are black, the rest of the body is white. Not infrequently a blue border marks the line of separation between the white and black. The bulls have strong black horns with tufts of hair upon the line uniting them. The body is angular, the back wide and powerful and the tail long with large switch. The milch cows have the well-formed teats and udder regarded as a sign of good milk production. Attention is now paid to the symmetry of these animals, although hitherto this character has been neglected. The live-weight of the cows varies between 500 and 600 kg. and that of the two-year-old bulls is from 600 to 700 kg. The milk yield is 4500 to 4900 kg. per annum, the fat percentage being from 3.05 to 3.20.

b) The Northern Dutch Pied Breed differs very little from the preceding; the white patches are more extensive, the hide is finer, the head wider and shorter, the chest deeper, the frame lighter and the muscles are better developed. The animals of this breed weigh some 100-200 kg. more than the Black Frisian. Their annual milk production reaches 4200 to 4600 kg., the fat content being 3 %.

c) The Black Pied Breed of South Holland is a native of the islands of the coast of Central Holland and differs greatly from the breeds hitherto described. The animals are distinguished by their squat appearance, powerful muscles, strong frame and the very clear demarcation of the white and black patches. The horns are yellowish with black points, the neck is somewhat short, the chest deep and wide, the legs short, but well set on. The annual milk yield is about 4500 kg. with 3.2% butter-fat. Some of the cows give daily as much as 30 kg. of milk with 4.9 % of butter-fat.

As a rule, the farms in Holland are small; in some districts such as Frisia and North Holland, they are entirely engaged in breeding milch cows, in which case butter and cheese are made. In Utrecht and some parts of South Holland, where intensive pig-breeding is practised, they are fed to the swine that are turned out to grass; 60-70 pigs can be reared with 25 dairy cows and 15 hectares of grass-land. Mixed farms consisting of  $\frac{3}{4}$  pasture and  $\frac{1}{4}$  arable land are chiefly found in the Southern islands of Holland, though they are also met with in the North. In the latter region, cattle are raised intensively on grazing, beets, beans, oats and clover. No cheese, is, however, made on the farms neither are any pigs kept, for all the

milk is at once taken to the great cheese factories in the neighbouring town.

The cattle breeding is very well-organised. The State gives prizes for bulls and supplies funds for the purchase of bulls and cows for breeding purposes; it has also established agricultural schools with the status of secondary schools. There are Bull-keeping Stations, Cow-testing Societies and Breed Societies. An interesting innovation in scoring has been adopted at Shows and Competitions, consisting in giving 100 points to each cow according to the quality of its different organs; no cow that has been accredited with less than 75 points may be entered on the pedigree Herd-book.

It is evident that in a country like Holland, where the different breeds of cattle are reared and valued for their milk production, the dairy industry is of great importance. Except during 3 or 4 months, the cows are milked in the field and a good milker is highly esteemed. Holland manufactures several kinds of butter, which are exported chiefly to England and Germany, sour butter, sweet cream butter, "whey butter" and centrifugated butter. Cheese is made in Holland to the extent of 90 million kg. annually and is exported to Germany, Belgium, England and France, in different forms and qualities, under special local names.

The Dutch cow-sheds are of the old type; the cows face towards the main wall, the food has to pass between the animals on its way to the manger and the water is distributed in buckets. The two principal drawbacks of such sheds is their low floor and the difficulty of drainage. Most of these defects have been corrected in a new type of Dutch shed. A third type is adopted in the cheese-factories in which the cows are arranged in two rows with a common manger between them.

The calves are given from three to four litres of freshly drawn milk daily for the first fortnight, after which they are also fed with other very nourishing foods. They are then put out to grass, but still receive three litres of milk and half a kilo of nutritive substances. On some farms, the calves are given milk alone for the first two months and afterwards whey with finely-ground maize until the tenth month. E. F.

1338 — **Effect of Variations in the daily Yield and in the Diet on the Composition of Goat's Milk.** — TAYLOR, W. and HUSBAND, A. D. (Rovett Research Institute, Aberdeen), in *The Journal of Agricultural Science*, Vol. XII, 2nd part, pp. 111-124, 3 diagr. Cambridge, April 1922.

Experiments regarding the influence of the diet on the compositions of milk have often given somewhat divergent results. Thus VOLT (1869) found, by experimenting on a bitch, that an excess of one constituent in the ration tended to increase slightly the percentage of the same constituent in the milk but the deviation from the normal composition was relatively small. INGLE (1901) found that a diet rich in protein increased the production of milk and its fat content. CROWTHER (1917) found that a diet rich in protein caused a decrease in the quantity of milk but increased the fat content. JORDAN and JENTER (1917) ascertained that the amount

of fat in the ration had no influence on the percentage of fat in cow's milk. MORGAN, BERGER and FINGERLING (1904) found in their experiments on goats that a diet poor in fat produced milk with a small percentage of fat. The writers remark that in the modifications introduced into the rations its calorific value is not always taken into account, for which reason the effect of changes in the ration may have been attributed to modifications in the constituents of the ration. Moreover, modifications in the volume of milk produced, as well as in its fat content or in the effect which the former has on the latter have in neither case been always taken into account. For these reasons the writers were induced to submit the question to fresh experiments.

I. — EFFECT OF VARIATIONS IN VOLUME ON THE PERCENTAGE COMPOSITION OF THE MILK IN THE CASE OF A GOAT KEPT ON A DIET OF UNVARYING COMPOSITION. — 1) The milk from 2 daily milkings was mixed, and the volume — percentage of protein — casein — albumen + globulin — non proteic nitrogen — fat — lactose — ash — were determined. As the goat was in an advanced stage of lactation, the volume of milk was continuously decreasing. The statement of HAMMOND and HAWK and other writers to the effect that there is an inverse ratio between the percentage of fat and the daily volume, was confirmed; it was also ascertained that the percentage of protein varies inversely to the volume, at least as regularly as that of the fat, although the variation is less marked. The percentage of lactose remained almost constant, and only varied between 4.19 and 4.30 %. The percentage of ash (0.94-1.08) showed a tendency to increase with the decrease in the volume of milk produced. The volume of milk in 24 hours and the percentages ascertained respectively on the 1st, 8th and 16th day of the experiment were:— 310 — 240 — 145 cubic cm. — Protein:— 4.50 — 4.86 — 5.40 % — Casein:— 3.07 — 3.41 — 3.79 % — Albumen + globulin:— 1.20 — 1.24 — 1.37 % — Non-proteic nitrogen:— 0.23 — 0.21 — 0.24 % — Fat:— 4.54 — 5.62 — 5.94 % — Lactose:— 4.26 — 4.35 — 4.30 % — Ash:— 0.98 — 0.97 — 1.04 %.

2) A goat was fed for 8 days with unlimited quantities of hay and oatmeal; for 2 days she was given nothing to eat, and beginning with the 11th day she was fed as before. The decrease and fresh increase in the production of milk were accompanied by the following changes in composition:— *at the end of the 1st period of feeding*:— Milk 460 cubic cm.; Protein 2.93 %; Fat 3.95 %; Lactose 4.07 %; Ash 0.79 % — *the 2nd day of fasting, respectively*:— 50 cubic cm. — 9.24 — 10.16 — 2.31 — 1.37 % — *the 2nd day after renewed feeding*:— 350 cubic cm. — 2.52 — 4.81 — 4.23 — 0.91 %. The decrease in the volume of milk was therefore accompanied by an increase in the percentages of protein, fat, and ash, and a decrease in the percentage of lactose.

3) and 4) The writers analysed the milk of a goat at the beginning and end of the lactation period respectively; they found that the natural decrease in the volume of milk is accompanied by the same variations in composition as those caused by fasting. It is therefore possible to formu-

late the following general principle:— with a diet of unvarying composition, the percentages of all constituents of the milk except lactose, tend to vary inversely to the volume of milk secreted; the percentage of lactose, which is normally very constant, tends to vary directly with the volume, and such variation is especially marked at the beginning and end of the period of lactation.

II. — INFLUENCE OF DIET ON THE VOLUME AND PERCENTAGE COMPOSITION OF THE MILK. — 5) After establishing the above principle in the case of a diet of unvarying composition, the writers investigated the extent to which it would be modified with diets containing an abnormally large quantity of one of the powerful constituents, protein, fat, carbo-hydrates. The results are summarized in the following Table. In calculating the average percentages of protein in the milk, non-protein nitrogen was excluded. The ration rich in fat consisted of:— 525 gm. of hay + 243 gm. of groundnuts + 102 gm. of oatmeal + 266 gm. of crushed carob-beans + 71 gm. of sugar; the ration rich in proteins was composed of:— 560 gm. of hay + 300 gm. of "plasmon" + 535 gm. of oatmeal; that rich in carbo-hydrates of:— 586 gm. of hay + 374 gm. of crushed carob-beans + 531 gm. of indian meal + 98 gm. of oatmeal. The calorific value of the rations was respectively 4225 -- 3702 -- 4636 calories.

*Average daily volume and percentage composition of milk for each diet period.*

Nature of diet	Volume of milk produced in 24 hours cubic cm.	Protein	Casein	Albumen + globulin	Non-protein nitrogen	Fat	Lactose	Ash
		%	%	%	%	%	%	%
Rich in fat (14 days) . . . . .	395	4.14	3.20	0.94	0.20	4.40	4.23	0.96
Normal (9 days) . . . . .	319	4.66	3.39	1.27	0.23	5.33	3.90	1.10
Rich in proteins (16 days) . . . . .	533	4.34	3.23	1.11	0.39	3.23	4.05	0.93
Normal (5 days) . . . . .	380	4.42	3.43	0.99	0.26	4.40	3.91	1.08
Rich in carbo-hydrates (13 days) . . . . .	439	4.42	3.34	1.08	0.16	3.52	4.17	0.92

In no case, was there a direct increase in the percentage of the constituent of the milk corresponding to the constituent in excess in the diet. Proteins, fat and ash all tend, though in different degrees, to vary inversely and lactose directly with the volume of milk secreted daily. Variations in the composition of the milk undoubtedly occur with the different diets, but these variations were of such a kind and degree that they may be attributed to variations in the amount of secretion and consequently in the volume of milk produced daily. Several other feeding tests gave similar results. In one of them, the ration rich in protein (305 gm.) contained

only 3700 calories, against 4230 for that rich in fat (136 gm.) and 4630 for that rich in carbohydrates; the volumes of milk obtained in 24 hours were respectively 540 — 400 — 440 — cubic cm. Proteins therefore have a marked stimulating effect upon the secretion of milk. Non-proteic nitrogen on the other hand, is directly proportional to the diet.

In conclusion, it appears that the percentage composition of milk is determined by the intensity of secretion, diet has no direct effect, except in the case of non-proteic nitrogen, which is not a product of the mammary gland; but it has an indirect influence through its effect on the volume of milk produced daily. A diet rich in proteins stimulates the secretion of milk (1).

1339 — **Bearing young Pigs without Milk Rations.** — SANDBRINK, in *Zeitschrift für Schweinezeitung*, Year XXIX, No. 8, pp. 116-121. Neudamm, May 1, 1922.

Milk has always been much used in rearing young pigs and before the War it paid well to employ milk for this purpose. On the other hand, the supply of milk has decreased of late years, whereas the amount required to meet the requirements of the population has increased, so that breeders no longer include milk in the rations fed to their pigs. In order that the young animals shall not suffer from this change, the author advocates the rearing of sows with abundant milk production that will suffice for the whole litter of little pigs. He mentions some instances observed at the Ruhlsdorf Experimental Pig-Breeding Station. One sow had sufficient milk, to feed the 9 piglings of her fourth litter for 3 weeks when they reached the average weight of 16.7 kg. In addition, although she had been served again on the 6th week, she acted as foster-mother to 5 other young pigs for 3 weeks. The same sow had suckled 11 out of the 15 piglings of her first litter. These little animals weighed on an average 14.64 kg. at the end of 10 weeks.

A second sow reared until fully grown 7 young pigs of her 3 first litters and transmitted to her descendants this extraordinary capacity of milk production. One of her daughters reared for 10 weeks 10 little pigs, which attained the average weight of 8.82 kg. and suckled 9 pigs of her second litter. A third sow suckled for 10 weeks 9 young pigs till they reached the average weight of 23.22 kg. (one weighed as much as 28 kg.) The sow lost 25 kg. whereas the ordinary decrease in weight during the 10 weeks' suckling (at Ruhlsdorf) is only 10 kg., and the customary weight attained by the little pigs is 15.2 kg.

In order to increase milk production, the author advises feeding sows for 5 weeks before farrowing and throughout the suckling period, with nutritious foods rich in protein (2), and accustoming the young animals.

(1) A paper by R. W. CLOTHIER entitled "Seasonable Variations in Butter-Fat Content of Milk in Southern Arizona," accompanied by a bibliography of 100 publications has appeared in *Society for the Promotion of Agricultural Science, Proceedings* Vol. 39, pp. 75-112, 1919, and was revised in *Experiment Station Record*, Vol. 46, No. 7, p. 679 Washington, May 1922. (Ed.)

(2) The breeder must vary the quality and quantity of the food according to the particular sow, for no two animals are alike in their requirements. (Author's note)

from the beginning to take other foods in addition to the sow's milk. In this way the dam loses less weight, the litter fattens more rapidly, and the sow can be served again after the 6th week without the young pigs suffering from the necessary change in the milk of their dam, as they are already able to consume large quantities of solid food.

E. F.

1340 - **Summer Pig-Breeding in Germany.** — MÜLLER, in *Deutsche Landwirtschaftliche Tierzucht*, Year XXVI, No. 2, pp. 15-17. Hanover, January 13, 1922.

Rearing pigs in the summer and turning them out to grass is very profitable both from the economic and hygienic standpoints, for the animals do not require artificial feeds which are scarce and costly, while from passing many hours in the open, they become more robust and disease-resistant. On the other hand, care must be exercised in the choice of a grazing-ground, which must be under young grass, for the pig unlike the ox, cannot eat large quantities of indigestible food. The grazing question having been settled, it next remains to decide whether supplementary food should be given. This depends upon the quality of the pasture and the stage of the animal's development. The author gives in this connection the results of three experiments carried out at the Ruhlsdorf Experiment Station.

During the summer of 1919, 17 pigs varying in age from 12 to 16 months were turned out from the middle of May to the middle of September into a field of cereal stubble, clover, and irrigated meadow-grass. In spite of the dry summer, the animals found plenty to eat and increased in live-weight 166 gm. per head and per day.

In 1920, 8 adult and 7 young sows were kept at grass in an irrigated field. The experiment was to have lasted 4 months, but was reduced to 11 weeks, as the animals were about to farrow and therefore needed the addition of a ration rich in albuminous substances. The older sows behaved as usual, their average increase being 11.5 kg. per head; the younger sows only increased 5.95 kg. in weight, although the gain proportionate to that of the other sows and to their own initial weight would have been 7.5 kg.

In 1921, the animals were first grazed on meadow clover and subsequently on an irrigated meadow-grass; only adult sows were turned out, their average increase in live-weight was 13 kg. It should be noted that the weight of the sows diminished after the litter was weaned because the nutritive value of grass is relatively less than that of the albuminous substances fed during the suckling period.

The above-mentioned instances show that it is possible to keep adult swine at grass. The author has carried out experiments to determine whether young pigs can pick enough food in the fields, or require a supplementary ration. Sixty-six young sows were divided into 6 lots. The 1st received meadow-clover and  $\frac{1}{2}$  kg. (per head and per day) crushed soya; the 2nd was only given meadow clover; the 3rd had irrigated meadow-grass and  $\frac{1}{2}$  kg. soya; the 4th only irrigated meadow-grass; the 5th



a special grass mixture (1) and  $\frac{1}{2}$  kg. soya — the 6th only the mixed pasture.

The animals used in the experiment were 7 months old; their average initial live-weight was 60 kg. The results obtained showed that the increased weight per head in the lots given soya in addition was 100 gm.; the pigs given no supplementary ration lost 13 gm. per head per day. In order to obtain an increase of 1 kg. in live weight, 6 kg. of soya were required in the case of the animals fed on meadow clover, and 4.4 kg. and 4 kg. of soya respectively for those that were fed on irrigated meadow grass and the mixed pasture. Grazing therefore does not give satisfactory results with growing animals and sometimes causes a diminution in weight.

E. F.

1341 - **Breeding Autumn-Farrowed Pigs in the United States.** — CASERMENT, D. D., in *The Breeder's Gazette*, Vol. LXXXI, No. 10, pp. 323-324. Chicago, March 9, 1922.

On a Kansas farm, 72 sows were mated with boars of different breeds in May and March 1921.

Twenty-one Duroc-Jersey sows (the number was subsequently reduced to 11 by sale) were served by 2 Duroc-Jersey boars, and 12 Poland China sows by 2 Poland China boars.

A third lot of 8 Duroc-Jersey and of Poland China were served by one White Large English Yorkshire boar, and one Duroc-Jersey sow was accidentally served by a Poland China boar.

Fifteen sows (5 per lot) did not prove to be in pig. During June, July, and August, the sows were turned out to feed in a lucerne field and received a small maize ration. At the farrowing season, these animals were collected into several lots and placed in a field provided with sheds and sties, so that each sow could choose the shelter it preferred.

Between September 1 and October 3, 44 of the sows farrowed; the litter sired by the White Yorkshire boar was composed entirely of white piglings. The Duroc Jersey sows proved more prolific than the Poland China sows, and the sows of both breeds served by the white boar had larger litters than those mated with a boar of their own breed.

Out of 401 young pigs, 38 were born dead, the 363 others had decreased in number, by October 31, to 195, viz., 4.15 piglings per sow. This high rate of mortality is difficult to explain, for all the young animals appeared strong and vigorous; it is however most probable that the sows were over-fat and the temperature was too high at the time of farrowing to obtain satisfactory results.

In many cases, the mothers proved bad nurses. The survivors however appeared more lively than usual and had excellent health. The piglings were inoculated with serum and vaccin after weaning, about December 13; on the same day, 73 of the largest animals, which already turn-

(1) This is obtained by sowing per hectare: 2 kg. *Phleum pratense* — 30 kg. *Poa pratensis* — 2 kg. *Poa trivialis* — 10 kg. *Lolium perenne* — 8 kg. white clover — 4 kg. yellow clover.

ed the scale at 30 kg., were isolated and turned into an extensive grazing-ground.

The author is of opinion that it is too soon to make a satisfactory comparison between the following weights reached by the pigs of the different breeds at the date of the publication of this article.

Breed	No. of pigs	Weight in kg.	Age in days
Duroc-Jersey . . . . .	88	27.21	111
Poland-China . . . . .	16	23.68	94
Crossed with Yorkshire . . . . .	79	28.03	103
Hybrids Duroc-Jersey × Poland-China . . . . .	2	14.96	73

From these weights, no decision can be made as to the respective merits of any one race. The white pigs appear the heaviest, because they are the largest and fattest, but on comparing their age with their weight, it is seen that this is not a fair inference to draw. The superiority or inferiority of the white animals could only have been determined 100 days after the publication of this article viz., on April 15 (the probable date of their sale), at which time each pig would have weighed about 91 kg. The superiority of the white pigs as regards fertility and disease resistance is however clearly shown by the following Table.

Breed	Mortality at birth			Piglets that survived 105 days		
	Total births	Born dead	%	Pigs born alive	Alive on 105th day	%
Duroc-Jersey . . . . .	228	23	10.6	205	88	38.5
Poland-China . . . . .	34	11	20.0	43	16	29.6
Crossed with Yorkshire . . . . .	116	4	3.5	112	79	67.0
Totals . . . . .	398	38	—	360	183	—

The laws of hereditary transmission made it possible to predict that the mating of the thin spare Yorkshire boar with quieter and fatter sows would produce vigorous healthy offspring. Other experiments which are in progress will undoubtedly afford further proof of this superiority. E. F.

1342 - Development and Feeding of pure bred Yorkshire Pigs from the Time of Weaning to the Beginning of Fattening: Observations at the Lodi Experimental Cheese-making Institute. — FASCETTI, G. in *Annali dell'Istituto di Cascio in Lodi*, Vol. I, No. 4, pp. 134-140. Lodi, September 1922.

The critical period in the feeding of pigs in establishments where it is based on whey, is that between the time of weaning and the beginning of

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fattening. As a contribution to the knowledge of food rations which are suitable and of the increases in weights which occur during that period, the writer publishes the following data relating to the piggery attached to the Lodi Experimental Cheese-making Institute:—

AVERAGES FROM APRIL 30 TO JUNE 30.

Initial weight per head . . . . .	22.50 kg.
Daily ration per head :—	
Whey . . . . .	5.80 "
Indian meal . . . . .	0.25 "
Bran . . . . .	0.24 "
Average increase per head . . . . .	10.00 "

AVERAGES FROM JULY 1 TO AUGUST 30.

Initial weight per head . . . . .	32.50 "
Daily ration per head :—	
Whey . . . . .	9.50 "
Indian meal . . . . .	0.40 "
Bran . . . . .	0.40 "
Average increase per head . . . . .	17.80 "

F. D.

- 1343 — **A Bavarian Breed of Pigs in Process of Extinction.** — STOCKKLATSNER, in *Süddeutsche Landwirtschaftliche Tierzucht*, Year XVII, No. 9, p. 101. Munich-Hanover, May 5, 1922.

The half red Bavarian "Landrasse" variety (local breed) was very common up to fifty years ago in Bavaria, in the north of the Palatinate; it was and still is known by the local name of "Triebsau". The animal had long legs and a large frame; it was excellent for extensive breeding, for it was accustomed to feed itself at pasture from spring to autumn. Its products were much in demand on the market. By the gradual substitution of intensive for extensive breeding this hardy race which developed slowly, had to give place to finer and more precocious races much less resistant to disease. To prevent its extinction a few specimens are now being reared separately in certain establishments and their crossing with selected pigs has given excellent results.

Experiments are being made on crossing with improved "Landrasse" pigs. E. F.

- 1344 — **Studies of the present position of Pig Breeding in Germany and in Australia.** — I. MÜLLER, *Die deutsche Schweinezucht in Vergangenheit und Zukunft*, in *Deutsche landwirtschaftliche Tierzucht*, Year 26, No. 4, pp. 35-36. Hanover, January 27, 1922. — II. PERKINS, A. J., *The Pig Industry: A Neglected Source of National Wealth*, in *Department of Agriculture of South Australia, Bulletin No. 161*, pp. 2-20, 11 tables. Adelaide, July 1922.

I. — **PIG BREEDING IN GERMANY: PAST AND FUTURE.** — Before the war Germany owned 25 million pigs. The breeders fed their pigs in many ways: most of them had founded large industrial breeding establishments where the pigs were fattened quickly and either fed on German produce

(barley, potatoes, skim-milk) or else mainly on American maize and Russian barley. When the war broke out and the frontiers were closed against all imports, these establishments stopped work, for the country no longer furnished sufficient produce and none of sufficiently good quality; those who only used German produce were able to keep on their industry for a short time, but they also had to give it up on account of the scarcity of food and rationing. However, in spite of the difficult conditions created by the war, breeding was still possible on farms where the pigs fed on acorns in summer and were given large rations of turnips in winter and only consumed small quantities of foods rich in albumen (fish-meal, etc.). On the other hand owing to the gradual industrialisation of pig breeding this class of breeders was a small one and, consequently, the want of pork during the war and the reduction in its consumption became very marked and caused the number of pigs to fall to 5 millions. The number is now increasing daily and the increasing consumption of pork shows that the Germans cannot do without it even though the price is high. In fact, owing to the present cost of barley, 300 marks per quintal, a breeder cannot sell 1 quintal live weight of pork for which 5 qx. of barley are necessary, at less than 1700 marks. Increase in the production of pigs is impossible with such prices and in places where the industrial pre-war methods were followed agricultural methods have now to be substituted. This means increasing the period of fattening from 9 months to 1 year though the number of pigs required may be obtained in the course of time.

From spring to the end of autumn, and even in winter on fine days, the pigs live in the open and graze. As winter feed, tubers and roots are used. Turnips make one of the best feeds; next come potatoes, mangolds, swedes and carrots. The choice of these feeds is purely experimental on the part of the breeder, who knows that potatoes are best for fattening and turnips for rearing. These foods, rich in carbo-hydrates but poor in albumen should be mixed with others (beans, peas, lupines). Such products as fish-meal, blood-meal, etc. can also be used but in small quantities.

Sows suckling their young get turnips or potatoes and other very nutritious feeds so that they may lose as little weight as possible. The young pigs remain with the sow for 8 or 10 weeks. As from the 3rd week, they are fed with potatoes, fish-meal, crushed beans (without milk); they are then considered adult, go to graze in summer and are fed on turnips in winter. When the animal has reached a certain weight and age it is put to fatten and fed mainly on potatoes of which as much as it will eat are given. Boars and breeding sows kept for the purpose should be fed just sufficiently to prevent their losing weight; for this they should be turned out to graze in summer and given young dry clover and turnips in winter.

The commonest breeds of pigs in Germany are improved white pigs and improved "Landschweine" (pigs of the country).

The differences between the two races, owing to very extensive improvement, is small and is often merely a matter of the length and arrangement of the ears. For this reason the breeder should not let himself be influenced

too much by the question of breed in estimating the qualities of an animal nor when choosing an animal for breeding, consider only fine shape but also the number of teats, the fecundity of the sow and the rate of growth of the young pigs. Often the finest looking animals give a smaller quantity of lard, while the sows are not prolific and the boars do not breed well.

II. — THE BREEDING OF PIGS IN SOUTH AUSTRALIA AND ITS IMPORTANCE AS A SOURCE OF NATIONAL WEALTH. — In 1919, Australia owned 755 494 pigs, which was a decrease of 20 % as compared with 1900. In South Australia itself there were 60 000 pigs in 1919, while there were twice that number in 1890 and three times as many in 1884. This very considerable decrease indicates that pig breeding does not flourish in Australia at present. The bad health of pigs is a secondary and partial cause, but does not depend on the general climatic conditions of the country, which, on the contrary, are very favourable, nor on epidemic or sporadic diseases, which are rare and may easily be avoided if the animals are allowed to live in the open with as much room as possible and in strictly hygienic conditions. The main reasons are the carelessness and want of experience of the local breeders who do not know how to organise a favourable market for the export of their produce.

Such a market can only be found abroad, for local consumption is very limited, not more than 70 000 pigs a year, and is often an insufficient outlet for the production. To this must be added frequent and considerable fluctuations in prices, which are very risky for an industry such as pig breeding which requires a certainty of profit over a fairly long period. On the other hand there are at the present time special conditions which suggest pig breeding as the only resource for a large part of the national economy. Up to date cultivation in Australia has been on a 2 or 3 year rotation for a single crop, arranged somewhat as follows:—

	2 year rotation	3 year rotation
1st year	Fallow	Fallow
2nd "	Wheat	Wheat
3rd "	—	Grazing

This method was economically satisfactory so long as the land owned by the breeders could be extended and purchased cheaply; but now conditions have changed, the area of estates goes on decreasing slowly but constantly and the cost of land steadily rises. A more intensive method of cultivation which will give 2 crops every 3 or 4 years is therefore imperative. But the growing of wheat after wheat cannot be recommended; wheat must be grown alternately with another cereal, for example barley and preferentially Cape barley, oats, etc., so as to get the following rotations:— a) fallow — wheat — barley or oats; b) fallow — wheat — barley or oats — grazing.

In Australia, there are at present about 100 000 acres of barley, of which the produce is difficult to distribute owing to the fluctuating conditions of the market.

If the above mentioned rotation is adopted there would then be about 1 000 000 acres under cultivation. The only way of utilizing the yield which otherwise could not be used, as the prices abroad, for example in England which imports largely, are insufficiently remunerative, would be to use it for feeding pigs. The writer describes some experiments made with the object of determining the conditions of rearing pigs on barley. These experiments gave the following results:— Twelve young pigs whose total weight was 620 lb. (about 51.67 lbs. each) were fed for 6 weeks so that they reached a weight of 1150 lb. (about 97 lb. each). During this period they were fed as follows:—

Crushed barley . . . . .	37.8 bus.
Scraps of meat . . . . .	168 lb.
Skim-milk . . . . .	924 lb.

This feeding caused an increase in weight of 534  $\frac{1}{2}$  lb.

Without reckoning the barley, the net cost was £1 8s. for the scraps of meat — 15s. 5d for the skim-milk — 18s for miscellaneous expenses — or a total of £3. 1s. 5d. The value of the increased live weight, taking pork at 8d. a lb. (the current rate at the time in the neighbourhood) was £17. 16s. 4d.; subtracting from that sum the previous total £3. 1s. 5d., there remains £14. 14s. 11d. for 37.8 bus. of barley, that is to say that each bushel of crushed barley brought in 7s. 10d when at that time the price of barley in the market was about 2s. the bushel. These conditions, in which breeding would be very profitable, are exceptionally favourable. At any rate, so long as the pork could be disposed of at a minimum price of 4d. per lb., breeding would always show a profit and the barley would thus be used to great advantage as a feed for pigs.

As has previously been stated, the local market could not absorb all the pigs which could be fed on barley produced on 1 000 000 acres; other markets must therefore be sought.

Great Britain is one of the countries where the importation of pigs is very important. In 1919, it imported 12 432 945 cwt. of pork worth £109 430 304 or 18.86d. per lb. and this item stood first among agricultural products, exceeding even wool in value. The price of 18.86d. per lb. is certainly remunerative for those who supply Great Britain; among the latter the United States comes first with 9 480 852 cwt., Canada next with 2 169 010 cwt., these quantities being worth £83 577 632 and £19 534 159 respectively. These figures show that 94 % of the produce of pig breeding consumed in Great Britain comes from regions where the agricultural conditions are, after all, very similar to those in Australia; and while in North America pigs are fattened on maize, in Australia they would be fattened on barley which gives a much better quality of lard. But in the United States there are 709 pigs per 1000 inhabitants; in Canada 470; in the Common-

wealth of Australia 141; and in South Australia only 129. There is, in short, the possibility of disposing of the surplus production of pigs of Australia in England and France, but this can only occur if the preparation and transport of the products has been previously assured. Despatch as frozen meat suggests itself as simplest but frozen pork only represents 13 % of the British import, which consists mainly of lard and hams. On the other hand the despatch of these two products is a difficult matter for the present, for Australian hams and lard are very different and often inferior in kind and quality to those to which European consumers are accustomed. Hence they could not compete successfully with the products of the United States, a country which has held for many years the European pig market and thoroughly understands the tastes and preferences of the consumers. The difficulties are partly due to the breeder, who does not breed the most suitable races, and partly to the butcher who is often careless in preparing the meat. However, if there were a demand at stable and remunerative prices the breeders of Australian pigs would certainly be impelled on their own account to improve production. According to the writer, experts familiar with the most up to date methods of breeding and specimens of the best breeds should be brought over from America, so as to enable large establishments to be started in which expenditure and loss would be reduced to a minimum. Private persons might with advantage interest themselves in such enterprises and Government assistance should be forthcoming. E. F.

1345 - New Methods of Pig-Breeding in Germany as the most effective Means of Increasing Meat and Fat Production. -- PROBST, in *Zeitschrift für Schweineucht*. Year XXIX, Nos. 3-4, pp. 33-37 and 49-57, figs. 5. Neulamm, February 15-March 1, 1922.

Pig-breeding could be made far more profitable than it is at present, if the results of the most recent scientific experiments on the subject were applied to the industry. This remark holds good for Germany more than for any other country, since owing to the large number of swine reared and fattened there, a very large increase in meat and fat production could be obtained by avoiding common errors and getting rid of the negative factors neglected by practical breeders.

Very frequently, unprolific sows which are bad nurses are employed, fattening is carried out in an unsystematic fashion, and the animals live under unhygienic conditions, and are thus exposed to numerous diseases. Some of the piggeries are so badly built and kept as to exercise a deleterious effect on fattening and breeding. The boars are purchased in a haphazard manner, only the shape and size of the animals being taken into account without any guarantee as to their genetic qualities. The breeders usually do not keep a pig-book, or if kept, it is so incomplete as to be of little use. In order to correct these defects, the author advises that more scientific methods be adopted in the large establishments. It would, for instance, be necessary to collect, at these breeding stations, boars characterised by special qualities, and to cease breeding

from well-shaped, but unprolific sows. In the author's opinion three or four such stations, each possessing 20 brood-sows would be sufficient to distribute throughout Bavaria, directly or indirectly, a large number of animals for breeding purposes and considerably to improve the local production within the next ten years.

In systematic breeding no sow ought to be used that has any defect whether from the point of view of fertility or disposition, or which has proved a bad nurse. The boars chosen should be well-shaped, but must belong to a line known for its excellent and constant characters, thus giving the surest guarantee of their capability as sires. In order to start a breeding Station the young boars and sows must be the offspring of good sows, in which case some of the number will certainly make valuable breeding animals and probably produce progeny endowed with their own characters. By further selection it will be always possible to continue improving the quality of the breeding-stock.

In order to effect these reforms, a pig-book is absolutely necessary in large Stations, although to keep it properly requires much time and attention.

The author recommends a pig-book divided into 6 parts such as he suggested to the Bavarian Minister of Agriculture and describes its construction and method of use.

1) Register of the herds (in German *Herdbuchformblatt*). This is most important for the breeder, and shows at a glance the value and characters of the animal. Two pages are reserved for each individual. The number, name, date of birth, etc. are first entered, a space being reserved for the reasons of the animal's possible removal from the station. In another division is given the animal's pedigree to the 4th generation. On a separate part of the page are registered the following particulars: date of birth — number and weight of the newly born pigs — number, weight, growth, characteristic shapes of the young pigs reared — if the animal is a sow. If it is a boar, the number of sows it has served and the size of the litters are noted. In the case of each parent, the name, number, qualities and defects are registered. This modification in the usual tables is very useful, for the good or bad qualities of the animal's parents are at once seen; further, it is the only way of determining and demonstrating the laws of heredity in swine.

In another column are set down the length and quality of the different parts of the animal, to each of which a special number corresponds that marks its value. In systematic breeding establishments, no animal with a score lower than "very good" should be reared. The author regards as arbitrary the common practice of adding together the various points for the different parts of the body and considering their sum total as an index of the value of the pig.

On another part of the form are entered the number and shape of the teats, the weight of the sow and its length at different ages. The author recommends that the adult animal should be weighed and measured at least once a year.



2) Pedigree (*Ahnentafel*). On this are entered the progenitors of each animal as far back as the 7th generation, with their good points and defects. It is an extended form of the table given in the Pig-book.

3) Album of photographs (*Lichtbildformblätter*). This contains the photos of the most valuable animals in the breeding-station.

4) Pigling book (*Ferkelbuch*). In this are entered the characters and peculiarities of all the pigs farrowed every year by each sow.

5) Piggery-book (*Stallbuch*) a reproduction in pocket form of the first book. Compiled for the practical breeder.

6) Book of Weights (*Wagbuch*). In this are noted the weight of each pig in the breeding-station. Adult animals should be weighed four times yearly, while growing pigs must be weighed once a month.

7) Breeding Societies Register (*Aufnahmebuch*). This book is designed for Societies consisting of several breeders and gives in a reduced form the *Herdbuchformblatt* of each.

E. F.

1346 - **The Expediency of Rearing Swine at Grass in South Germany.** -- SCHNITZER, in *Zeitschrift für Schweinezucht*, Year XXIX, No. 7, pp. 97-100. Neudamm, April 15, 1922.

One of the problems that German pig-breeders are now studying is how to feed their animals in order to obtain a reasonable profit in spite of the high price of food. One of the best possible methods is to turn the animals out to grass, a course that has been very generally advised. The author however is doubtful as to its expediency and makes reference to the fact that the pig-breeding conditions in North Germany are different from those obtaining in South Germany. In the north, there is a limited number of large industrial breeding farms as well as many average sized farms, and the grassland is either quite near or actually surrounds the homesteads. In such circumstances it is natural that the pigs should be allowed the run of the meadows; the doors of the sties are opened in the morning and left open throughout the day, so that the animals can come and go at will. On the other hand, whereas the large farms possess grass-land that is laid down and used periodically, there is no true pasturage in the smaller holdings, for as soon as the young grass appears in the spring, it is at once eaten.

The condition of affairs is totally different in South Germany (Württemberg, Grand Duchy of Baden etc.), where small and medium-sized farms predominate and pig-breeding presents many practical difficulties. The piggeries and farm-building are not isolated in the middle of meadows, but form part of the village; the fields possessed by each pig-breeder are scattered, and often lie far from the centre of habitation; the farmer has therefore not sufficient grazing ground for his swine. Turning his herds into the stubble fields would entail especially in the case of small holdings, the expense of a swine-herd to drive the animals from one field to another and the pigs would be obliged to walk long distances and this they could not stand as they belong to greatly improved breeds. For the above reasons, it is clear that grazing is not a suitable method for rearing pigs

[1345-1346]

in South Germany, at all events on small and average sized farms situated in villages. From the hygienic point of view, the animals do as well if left in the open yard all day as if they had the run of the fields. The author is of opinion that all idea of rapid fattening by means of very nourishing artificial foods should be abandoned and natural feeds used, although with these the pigs put on weight more slowly.

In conclusion, he impresses upon pig-breeders the paramount importance of the three factors: light, air and exercise.

E. F.

1347 - **Lucerne as Pasture for Pigs, in Germany.** — Fröhmich, in *Zeitschrift für Schweinezucht*, Year XXIX, No. 6, pp. 81-84, 1 fig., Neudamm, April 1, 1922.

The general importance of lucern as a feed has always been recognised in Germany and the question of its particular utility as pasture for pigs deserves consideration.

The writer, after finding that the experiments on the subject hitherto made in Germany were insufficient, undertook a series of researches to ascertain if it were really profitable to utilize lucern in this way or not.

Twenty two young "Landrasse" sows, slightly modified by crossings with a superior breed, of a total weight of 1880 kg. (average 85 kg. each) and a sow weighing 142 kg. were put out in a lucern field with four wooden sheds where they could graze for about 2-3 hours daily. As the lucern was already well grown the animals were allowed to graze for one morning only, the lucern was then cut; three days later the sows were again allowed to graze; grazing had to be suspended on two other mornings after the second and third mowings. The lucern was cut three times, it was found that the sows did not eat it so readily as before, perhaps because it had grown during very dry weather: the sows only ate the upper part and did not touch the lower; for this reason other freshly cut lucerne had to be given to them.

Eighteen animals remained on the pasture for 102 days, 5 from 63 to 70 days; there was an average increase of 122 gm. each per day. On the other hand in the case of 5 sows the increase in weight was very much less than for the others; the writer therefore recommends ascertaining whether the animals are profiting by the pasture by weighing them regularly and eliminating those which are not giving good results. In addition to the lucern eaten by the pigs the lucern field yielded 19.5 qx. of hay in the three mowings and the area of the pasture was such that it would certainly have yielded a total of 70 qx. of hay, equal to 175 or 200 qx. of green stuff; the daily ration of each sow was therefore 7.5-8.5 kg.

In conclusion it may be stated that pasture has considerable food value; really lucern is one of the best foods for animals on account of its considerable albumen content, and they eat it readily, at any rate so long as it is not too old. Later on many of the sows littered and produced a considerable quantity of milk.

E. F.

[1346-1347]

1348 - Rape as a valuable Pasture for Pigs. — RICE, B. J. (Illinois Experiment Station), in *The Breeder's Gazette*, vol. LXXXI, No. 16, pp. 329-350, 1 fig. Chicago, Ill., apr. 20, 1923.

Rape is one of the best forage crops for pigs, and compares favourably with lucerne and young clover; results of analysis show that it contains 20-25 % of protein and has a high content in ash and a low content in cellulose. The full-grown crop is succulent and very acceptable to animals; in favourable conditions one acre of rape provides sufficient pasture for 12 to 20 pigs from June 1 to October or November. By sowing in April it is possible with care to feed six porkers; the June growth, if there is a slight rainfall, will feed the pigs during the summer months or in the early autumn, when the pigs who are now much larger, can eat a considerable quantity. Animals fed on a succulent nitrogenous crop such as rape in July, August and September fatten more quickly and the meat finds a ready market.

Both statistical and experimental results agree in demonstrating that rape is economically one of the best of pastures. During the experimental period at Illinois, pigs who were fed on maize and pastured on lucerne required for each increase of 110 lb. in live weight about 6  $\frac{1}{2}$  lb. of maize more than the pigs who were fed on maize and pastured on rape. At the Purdue University pigs fed on rape put on 18 ounces of weight daily and those fed on clover only just over 1 lb and the quantity of supplementary feeding necessary in relation to increase in weight was less with the rape. The pastures used on the farms, which in 1916 and 1917 gave the best selling and most profitable pork, were clover, lucerne and rape.

Rape is not only useful as a pasture in summer and autumn but can also be sown with maize; it makes better growth when the maize is not too closely sown. The crop cannot entirely replace the nitrogenous feed, which is needed by maize-fed pigs, but can greatly reduce the requirement.

The use of rape has the disadvantage that the leaves are so heavy that the dew is not evaporated before noon; hence the young pigs get wet and may contract illness through exposure to the sun's rays. However it is always possible not to put the young pigs to pasture in the morning and to give them instead a dose of oil. E. F.

1349 - Pig-Breeding in Tuscany: its Difficulties and the Means of Promoting its Development (1) — PERCORA, V., *Dei fattori ostacolanti lo sviluppo dell'industria del maiale in Toscana, Relazione presentata all'XI Congresso degli Allevatori di bestiame della regione toscana, tenuto in Grosseto il 21 e 22 Maggio 1922*, 11 pp. Florence, 1922

In Tuscany it is possible and also economical to turn pigs out into the fields and allow them to feed on the grass throughout the year, as the winters are mild, and there are no prolonged droughts to destroy vegetation. As a matter of fact however except in the wooded districts, the healthy method of rearing swine in the open is not practised and the pig-breeding industry does not develop as it should. The author has investigated the causes of this failure and summarises them as follows: 1) prejudice on the

(1) See: R. August 1921, No. 842; R. September 1921, No. 939. (Ed.)

part of the peasant who believes that pigs must either roam at will, or else be always shut up in the sty; 2) the prevalence of infectious diseases; 3) lack of uniformity in production; 4) unsuitable feeding, especially in the case of young pigs; 5) defective piggeries; 6) want of cooperation among breeders.

Rearing pigs on the lucerne field costs less than letting them feed in the woods, provided the earliest-maturing and heaviest breeds are kept and they are given supplementary rations of concentrates and minerals. Selected breeds thus fed are no more resistant to disease than ordinary pigs.

The author agrees with Prof. FENZI, of the *Scuola Superiore Veterinaria* at Turin, viz., that swine-fever is only fatal when attended by complications which can be avoided by giving the animals an aperient, keeping them on a liquid diet and well-protected from the cold.

The stock now in Tuscany consists of a great variety of breeds: local Blacks, "Cintas", Middle Whites, Large Whites, and Large Blacks, together with innumerable ranges of admixture between them. A great step in advance would be made if it were possible to replace all these varieties by a single homogeneous race.

The "Cinta" is a thrifty, strong, fairly early maturing large animal and a good walker. It is especially suitable for rearing in the woods. As farm animals, the author advocates the hybrids resulting from the industrial (first generation) cross between the Large Black sow and the Large White boar (1), for they inherit the valuable qualities of both breeds and are much prized on the markets. The author also emphasizes the necessity of making separate boxes for nursing sows and of adopting self-feeders and automatic drinking bionghs.

F. D.

1350 - The Effect of Cod-Liver Oil on "Leg Weakness" in newly-hatched Chickens. — HART, E. B., HALPIN, J. G., and STEPNOCK, H., in *The Journal of Biological Chemistry*, Vol. III, No. 2, pp. 379-386. Baltimore, June 1922.

Fifty-seven Rhode Island Red chicks were divided into 3 lots of 19 each and shut up in small enclosures strewn with wood-shavings. The first lot received a daily ration of 97 parts wheat, 2 parts carbonate of lime and 1 part sodium chloride plus skim milk *ad lib*. The second lot were fed the same ration and given in addition 50 gm. cod-liver oil per kg. of feed; the birds took the oil mixed with the food without any apparent repugnance. The third lot which served as the control, received a very varied ration composed for the most part of wheat, oats and bran.

Of the 19 chicks forming the first lot, one died before it was a fortnight old, 6 died within 6 weeks and 8 within 8 weeks; 5 were killed for purposes of analyses. The plumage was ruffled and the birds showed a tendency to squat on the ground and other signs of leg-weakness.

All the birds of the second lot survived; they remained strong and active and were recognised as normal by expert breeders. At the end of

(1) This method has been adopted with success in Ireland and in England: See R. July 1922, No. 750; R. August 1922, No. 859. (Ed.)

4 weeks, 5 individuals were removed from lot I, and 5 from lot 2 in order to determine the phosphorus content of their blood. The results obtained are given in Table I.

TABLE I. — *Phosphorus content per 100 cub. cm. of serum in lots I and II.*

Lots I and II				Lot II			
Number	Lot I Age in weeks	Weight	Phosphorus	Number	Age in weeks	Weight	Phosphorus
10	4	105gm.	1.93 mgm.	25	4	100gm.	2.50 mgm.
11	4	95	1.07	26	4	145	5.15
16	4	115	2.80	27	4	90	2.73
17	4	120	1.40	34	4	120	3.80
18	4	120	1.73	37	4	120	3.80
Totals	—	555gm.	8.93 mgm.	—	—	575gm.	17.98mgm.

The uniformity of the results obtained in the case of the chicks of lot II prove the beneficial effects of the vitamin in cod-liver oil; in the same manner, the figures of Table I show that, except in the case of No. 16, the phosphorus content of the blood was much higher in lot II. The authors do not explicitly state that rachitis and leg-weakness are the same for they are still awaiting the results of further experiment, but they regard two facts as significant: a) cod-liver oil has a specific action on both rachitis and leg-weakness; b) the phosphorus content (which decreases in rachitic subjects), also fell in chicks suffering from "leg-weakness".

Six birds (weighing 200 gm.) were taken one after the other from the third lot and fed like those of the first. They grew normally for 3-5 weeks following the change of diet, but afterwards lost flesh and the characteristic symptoms of leg-weakness made their appearance; the plumage became ruffled, and the chicks crouched on the ground. After 4 weeks of the new diet, 3 birds (Nos. 39 — 40 — 41) were killed in order to determine the phosphorus content of their blood; Nos. 42 — 43 — 44 being killed successively for the same purpose. The results are given in Table II.

TABLE II. — *Successive Weights and Phosphorus Content of Serum in Lot II.*

Number	Weight at time of change of diet	Weight 2 weeks later	Weight 4 weeks later	Weight 6 weeks later	Phosphorus per 100 cub. of serum
39	300 gm.	470 gm.	390 gm.	—	2.41 mgm.
40	230	410	400	—	1.59
41	250	460	450	—	2.41
42	245	390	485	470 gm.	3.75
43	220	330	440	430	3.70
44	220	340	445	435	2.80

The phosphorus content clearly tends to fall, which is in complete agreement with the results obtained from the first lot. There are however variations which may be attributed to errors in the method of phosphorus determination (that of MARRIOTT and HAESSLER), or to the excessive shortness of the period during which the chicks were kept in the ration without oil.

The author concludes by stating that newly-hatched chicks can be reared on a ration consisting of wheat, skim milk and small amounts of salts, provided a considerable quantity of cod-liver oil be added during the time of most active growth. The efficacy of cod-liver oil is due to the vitamins it contains, the vitamins B and C being probably supplied by the wheat and skim milk (1).

E. F.

1351 - The "Type" in Poultry Breeding. — PROVENZALE, F., in *Allevamenti*, Year III, No. 8, pp. 204-307. Palermo, August 25, 1922.

In poultry breeding, as in other kinds of breeding an exact valuation of the characters which differentiate one race from another is necessary if crossings are to be effective and give products specially adapted for the object proposed. The writer groups the innumerable races of domestic fowls under 3 types. The first group (brachymorphous) is suited for table purposes and consequently its secondary sexual characters are slightly developed; in shape it is substantial and it has a marked aptitude for fattening. The second group (dolichomorphous) is used for egg production; its secondary sexual characters are highly developed: the hen is agile, robust, energetic; wiry. The third group (mesomorphous) is used for both purposes; its shapes are more harmonious and intermediate.

The writer states that the type is the only natural method of grouping the different races, the only method on which regular breeding and rational crossing methods can be based.

E. F.

(1) It might perhaps be well to refer here to the principal foods in which the presence or absence of vitamins have so far been determined. According to HARDY (Vitamins and the Food Supply, in *Journal of the Society of Chemical Industry*, Vol. 40, No. 5, pp. 70-82, London, March, 13, 1921), vitamin A (soluble in fatty substances) is found in: animal fats — fish-liver oils — green vegetables — yolk of egg — milk and butter — oleomargarine. The insufficiency of vitamin produces rickets, a checking and sometimes stoppage of growth, keratomalacia. Vitamins are absent from most vegetable oils, white bread, margarine, purified proteins and carbohydrates.

The vitamin B (antineuritic) is found in seeds (especially in the embryo, pericarp and aleurone layer), in yeast, and yolk of egg; it is wanting in white bread, polished rice, fats, egg albumin, and purified proteins and carbohydrates. Its absence causes a checking and sometimes a stoppage of growth, beri-beri and the polynucleitis of birds and rats.

Vitamin C (antiscorbutic, or water-soluble) is present in green vegetables (especially the Cruciferae) orange and lemon juice, tomatoes, germinating seeds and in carrots. It is absent from seeds, white bread, fats, yeast, and purified carbohydrates and proteins; shortage or absence causes scurvy. (Ed.)

[1350-1351.]

1352 - **Intensive Chicken Rearing.** — PLIMMER, R. H. A., ROSEDALE, J. L., TOPPING, R. B., CRICHTON, A., I. The Vitamin Requirements, Preliminary Experiment. — II. The Effect of "Good" Protein, in *The Biochemical Journal*, Vol. XVI, No. 1, pp. 11-22, London, 1922.

I. — Poultry-breeders usually consider that chicks cannot live normally under artificial conditions of housing and feeding, consequently they regard life in the open, access to grass and freedom of movement as indispensable to success in rearing the birds. Several investigators have however tried to keep a chicken in the laboratory; had their experiment succeeded, it would have been of great importance from the practical standpoint. So far, however, the results obtained have been far from satisfactory and the greater number of the workers attribute their failure to lack of, or a wrong method of supplying vitamins.

In order to decide the question, the authors undertook these experiments and succeeded in keeping several chicks in normal conditions of health, from July 13, 1920 to February 28, 1921, by feeding them exclusively on dry oat meal, a little milk and cod-liver oil containing the vitamin A, some autolysed yeast with the vitamin B, and lemon-juice with the vitamin C. The birds were found to show marked susceptibility to an insufficient amount of vitamin B. The amount of this vitamin required by the organism appears to increase in proportion to the increase in fats and carbohydrates and may be represented by 0.5 gm. of yeast per 30 gm. of flour, and 5 cm<sup>3</sup> of oil (for 11 birds), while 5 cm<sup>3</sup> of vitamin A and 30 cm<sup>3</sup> of lemon juice (vitamin C) daily is enough for 11 chicks. It should be noted that these are not the minimum figures, for since the vitamin requirements of poultry are unknown, the total amount given had to be determined in an arbitrary manner. Later experiments may be able to fix the minimum quantity of each vitamin. Out of 24 chicks, 12 reached maturity, one died as the result of accident, another succumbed at the beginning of the experiment, while a third fell a victim to fowl cholera.

At the end of August 1920, many of the birds suffered from weakness of the legs, but were soon cured by increasing the dose of the vitamin B, whereas an increase in vitamin C was without any effect.

II. — This second series of experiments was undertaken to confirm the results of the first, which appeared to prove that chicks could be reared in the laboratory, provided a sufficient quantity of the three vitamins were added to their rations, and to test the effect of "good" proteins on growth. Choice was made of a mixture of lactalbumin and caseinogen, both substances containing a large amount of lysin, with the required quantities of vitamins added. The protein brought about rapid growth; the cockerels began to crow when 40 days old, and the pullets laid their first egg at the age of 139 days. The cockerels weighed 1833 gm. and the pullets 1815 gm. The birds moulted quickly during October and their health was always good. It is an interesting fact that the beaks and legs of individuals thus fed were not pigmented. The yellow coloration of these parts of the body is derived from yellow pigments in the food which were entirely lacking in the experimental ration.

E. F.

353 - **Piscicultural Value of a Stream.** — JOLYET, A., in *Revue des Eaux et Forêts*, Vol. LX, No. 9, pp. 283-296. Paris, Sept. 1922.

The author gives the results of important experiments carried out by the University of Grenoble under the superintendence of Prof. LÉGER (1). They relate to:— Hydrologic considerations — Nature of the banks and bottom — Surrounding flora — Qualities of the water — Nutritive resources — Causes of destruction. The author also gives an account of some researches made by himself.

**HYDROLOGIC CONSIDERATIONS.** — The stream to be studied should first of all be divided into "sections", that is to say portions small enough to be sufficiently homogeneous. For the study of the hydrologic regulation the following should be noted:— 1) the width of the stream — 2) its depth; average depth; existence of shoals, which may be useful as spawning places, and holes (very deep places) where carp may take refuge for wintering and where trout like to stay when they leave the portion of the river containing salmonidæ and venture down stream into the portion containing cyprinidæ — 3) seasonal variations in depth — 4) the volume and speed of the flow and their seasonal variations:— floods and low condition of the stream are specially injurious if they happen during the spawning season.

**NATURE OF THE BANKS AND BOTTOM.** — The following should be noted:— slope of the banks, on which depends their suitability as spawning places) — petrographic nature of the banks and the bottom — colour of the bottom — whether it is strewn with scattered rocks or not, etc.

**SURROUNDING FLORA** — 1) *Riverside flora.* — Vegetation on the banks forming a screen shelters the water against the heating action of sunshine; this may be advantageous, by maintaining a suitable temperature for salmonidæ, but is not an advantage when cyprinidæ are concerned as their fry often require very warm water. It may also shelter the stream from wind and supply insects which, blown into the water by the wind, form a considerable part of the food of fish. It should therefore be noted whether the stream runs through a forest, a meadow, cultivated or uncultivated land; whether the banks are bare, turfed or wooded, etc.

2) *Aquatic flora.* — This flora can serve as food for the fish, directly in the case of a herbivorous species, indirectly by the animals which it harbours, in the case of all species. Lastly it is often useful for the spawn. Plants which branch most under water are the most useful, both because they harbour a greater number of animals such as worms, molluscs, crustacea and larvæ of insects and because they serve to support the spawn. From this point of view, water-cress, the water Ranunculus (preferred by pike for the deposit of its ova), etc. are very useful. On the other hand, plants with thick sub-aqueous stiff, unbranched stalks (reeds, reedmace, etc.) are "cumbersome" from a piscicultural point of view.

(1) *Travaux du Laboratoire de Pisciculture de l'Université de Grenoble*, 1909 and following years. Grenoble, Allier Frères, Edit. (Author's note).



QUALITIES OF THE WATER. — I. Physical qualities: —

1) *Temperature* — The mean annual temperature is of less interest than seasonal variations. It is specially important to note the periods during which the water reaches the temperatures required for the spawn of the principal kinds of fish:— 10° (perch, rudd); 13° (Prussian carp, pike); 17° (bream, roach, tench); 20° (carp).

On the other hand, the mean temperature during the 3 hottest months (June, July, August) and the usual maxima during that period should be noted. These high temperatures, as a matter of fact, influence the descent of the salmonidæ down stream in the rivers, as they influence the mortality among lampreys and shad after spawning. Further, local variations must be taken into account:— the "holes", where the water remains cool in summer, and bottom springs attract large trout and salmon going down to the sea.

2) *Limpidity*. — It is important to note whether the water is usually muddy or limpid, whether the periods of muddiness are frequent and whether they coincide with the spawning seasons. Even when not poisonous, matter in suspension is injurious to fish because it is deposited wherever the current slackens: these deposits cover the supports in the spawning places, hindering the fish from depositing their ova. They even cover the ova after spawning and hinder their hatching out. Finally the fish may have their respiration impeded by an actual obstruction of their gills: saw-dust especially may thus cause death by suffocation.

3) *Colour*. — To judge the colour, the water is examined in a test tube holding about 1 litre, placed on a sheet of white paper and compared with distilled water in a similar test tube.

II. CHEMICAL PROPERTIES. — These can only be determined by a series of chemical analyses. Certain indications however enable a rapid though rough, estimate to be made.

*Quality of water in relation to its fauna and flora.*

Quality of the water (1)	Fauna	Flora
Pure . . . . .	<i>Physa fontinalis</i> . . . . .	Watercress.
Indifferent . . . . .	Pond snail . . . . .	<i>Potamogeton natans</i> .
	Oval pond snail . . . . .	<i>Veronica anagallis</i> .
	<i>Planorbis marginata</i> . . . . .	<i>Veronica Beccabunga</i> a.
Unhealthy . . . . .	Red Cycas . . . . .	Waterlily.
		Rushes.
	<i>Bithinia impura</i> . . . . .	Dock.
		Loosestrife.

(1) This relates to the quality from the point of view of potability by man, but should be similar for fish.

1) *Smell and taste*. — Water which gives off a putrid smell and water which has a disagreeable taste or which is even simply flat, may be considered *a priori* as indifferent or bad.

2) *Fauna and flora*. — The annexed Table is copied from the book:— P. F. CHALON, *Les eaux souterraines*, Paris and Liège, 1913, libr. polytechnique.

3) *Aeration*. — A sufficiently aerated water should give off bubbles of gas as soon as it is placed on the fire in a thin metal vessel.

4) *Hydrotimetric degree*. — The nationality of the scale used must be indicated:— 1 degree on the French scale is equivalent to 0.56 of a degree on the German scale or 0.70 on the English scale.

5) *Percentage of organic matter*. — This is of interest because this matter is liable to undergo putrid fermentation, setting free deleterious gases.

FOOD RESERVES. — The production of young fish will not increase the number beyond that which the supply of food will support. These reserves are essentially of an animal nature and consist mainly of the lower animals. Among these aquatic invertebrate animals which probably serve as food for fish are:— all the Entomostraca (the lowest subclass of the Crustaceæ), which are sought after by young fish — Worms (*Lumbriculus*, *Rhabdocela*, *Tubifex*, *Trichodrilus*, *Nais*, etc.) — Amphipoda Crustacea or fresh water shrimps belonging mainly to the genus *Gammarus* — Insects:— larvæ of Perlidæ, Ephemeridæ, Phygadeuonidæ, Chironomidæ, etc.; “water spiders” (*Berris*, *Velia*, etc.) — Molluscs. It appears from M. LÉGER’s researches that to give one of the Salmonidæ the quality of flesh called “Salmon flesh” it is sufficient to feed it abundantly with shrimps.

The larvæ of Perlidæ live more especially in the streams containing Salmonidæ.

M. LÉGER observes that in the list of Invertebræ found in the stream under examination it is specially desirable to note those which are “dominant”, that is to say the species which are particularly abundant during the three hot months:— June, July and August, the fish feeding season. Land insects which fall into the water, or which are blown into it by the wind, or which, flying along the surface of the water, may be snapped up, form a considerable part of the food of the fish.

CAUSES OF DESTRUCTION. — Very numerous, especially for the ova:— infectious diseases, poisonings, poaching, destructive animals.

From an examination of all data relating to the piscicultural value of a stream it is possible to deduce the “biogenetic capacity”, that is to say the number of fish of such and such a species that the stream can normally harbour so as to produce fully. This idea comes in when it is a case of deciding:— 1) a reasonable number of young fish to put out in a stream; 2) the quantity of fish that may be caught.

To reduce the biogenetic capacity to figures, M. LÉGER suggests that a numerical value, in a scale running from 0 to 10, should be given to a stream.

A stream which only contains 15 to 20 cubic cm. of nutritive matter per sq. m. of bottom or per cubic m. of water may be considered poor. Very rich water contains 10 times as much or more.

Streams whose bottoms are constantly shifting, but have here and there a more stable pebbly bottom, where layers of diatoms, chlorophyceæ, mosses, etc. are formed and where consequently a few scanty larvae of insects (Ephemeriðæ or Perlidæ) are found can be valued numerically by 2 or 3, often more.

If the bottom of the stream is fixed and formed of rocks or large irremovable blocks of stone, the flora and fauna are richer and the biogenetic capacity may be as high as 3 to 5.

If the streams are less rapid, with tufts of aquatic plants here and there alternating with sand banks or have a rocky bottom harbouring a numerous fauna of larvae of insects and crustacea, the biogenetic capacity rises to 5 or 7 and may reach 9 if there are also quiet parts sheltering shoals of small fish e. g. minnows or loaches.

Lastly the richest streams are those which, winding about in fertile plains, have a regular, moderate current, slowed down here and there and whose bottoms are largely carpeted with the aquatic plants previously referred to or with large pebbles covered with Fontinalis and algæ in which swarm various aquatic fauna. Their numerical value, seldom less than 8, may reach the maximum if very favourable conditions of exogenetic alluvium, determined by crops or by the river-side vegetation, are added to the inherent nutritive richness of the stream.

The biogenetic capacity remains approximately constant over a width of from 2 to 2.5 m. along each bank of the stream, but beyond that it decreases rapidly. If the stream is over 5 m. in average width it must be taken into account in calculating the biogenetic capacity.

The *population formula* (N), expresses the number of fish which the stream should normally contain per kilometre of length; the *yield formula* (K), the quantity (in kg.) of fish which may be caught during a year per km. of length. These formulæ are respectively:—

$$N = 10 \beta (L + 5); \quad K = \frac{\beta (L + 5)}{2};$$

where L represents the average width of the stream and  $\beta$  the biogenetic capacity numerically valued from 0 to 10. F. D.

1354 — **Advantages of Keeping Carp in Ricefields for Fertilizing the Soil.** — CHIAPPELLI, R., in *Il Giornale di Riscultura*, Vol. XII, No. 9, p. 144. Vercelli, September 30, 1922.

On an area of 17 831 sq. m., with a total expenditure of 1681 lire for feeding, introduction of the Galician "mirror" carp, *Cyprinus carpio* var. *specularis*, superintendence and miscellaneous expenses, M. TAGLIABUE, at Morimondo (Province of Milan), has succeeded in getting a profit of 819.25 lire, after deducting expenses, corresponding to 450.45 lire per ha. (1).

(1) See R. Apr. 1921, No. 422 (Ed.)

To this profit should be added the advantages resulting from the decreased cost of removing grass and manuring and from the increased yield of rice. Moreover, the wheat which followed the rice gave a more abundant crop in the place where intensive rearing of carp was practised. The plot gave 23 qx. of paddy and 34 qx. of straw per ha. as against 17 and 21 respectively in the control plot. Keeping carp has therefore clearly a favourable action on the fertilization of the soil.

F. D.

1355 - **Piscicultural Research in Germany.** — *Zeitschrift für Fischerei und deren Hilfswissenschaften*, Neue Folge, vol. V, No. 1-2, pp. 205, 8 full page pl. Berlin, 1922.

The number reviewed contains the following papers:— 1) TORLITZ, Contribution to the question of the species of the common river eel, anatomo-biological research, with a bibliography of 40 publications, — P. SCHIEMENZ, Research work on the feeding of aquatic animals and especially of fish — 3) A. WILLER, Research work on the feeding of lower aquatic animals; the feeding of *Gammarus pulex* — 4) P. BROFELDT, winter feeding of the perch and the ruffe (*Acerina cernua*) — 5) E. DOBERS, Research work on the feeding of fish in natural conditions.

BROFELDT concludes from his experiments that the perch and the ruffe feed also in winter, though less than in summer. The smallest perch (up to 10 cm. in length) feed on Entomöstraca; those a little larger (from 10 to 12 cm.) feed on land animals; the largest probably only feed on fish. *Asellus* is the most important of the land animals; the larvae of *Chironomus* and worms of the genus *Tubifex* are also important; other land-dwelling animals are of negligible importance in the feeding of perch.

The smallest ruffes (up to 6-8 cm.) feed on Entomöstraca and larger kinds of land-dwelling animals, especially larvae of *Chironomus* and the isopod crustacea *Asellus*.

DOBERS made his experiments from July to October. The stomach contents of various species of fish are given in 8 large Tables and the whole is summed up in a 9th Table, from which the following facts may be deduced:—

Out of the 4 species examined, young fish and *Corixa* were only found in the perch (*Perca fluviatilis*).

Ephemera were only found as from September, during September in the perch only; during October in all 4 species; they were most important for the perch; least important for the roach (*Leuciscus rutilus*).

Chironomus forms the principal food of the perch and the ruffe (*Acerina cernua*), from July to October; they are of much less importance for yearling tench (*Tinca tinca*) and for roach.

Perfect insects (taken on the surface of the water):— of some importance for roach, in one case only, in July.

Chydorides (except the genus *Eurycerus*):— of some importance in October, for tench only.

*Eurycerus*: — important in the feeding of perch and ruffes in July-August.

*Daphnia*, *Ceriodaphnia* :— important for perch in July-August.

*Bosmina* :— very important for roach in September; not unimportant for roach and perch in July-August.

*Gammarus* :— more frequently found, during October, in ruffe than in the 3 other species examined.

*Algæ* :— found only in roach, in October, in two ponds, but in them of fundamental importance.

A comparison of the feeding of these species, commonly called and erroneously, herbivorous ("grünweide") with that of carp proved that they are formidable competitors and that consequently their presence is not desirable in ponds where carp are kept. The least serious competitor is the tench; as a matter of fact tench and carp are often kept together.

A smaller number of examinations were made of "sandra" (pike-perch) (*Lucioperca Sandra*), gudgeon (*Gobio fluviatilis*), three spined sticklebacks (*Gasterosteus aculeatus*), bream (*Abramis brama*) and young fish, most of them probably roach.

The following were found :— in the pike-perch, larvae of Chironomus; in the gudgeon Chydorides, remains of Cladocerae and larvae of Chironomus; in the ruffe, larvae of Chironomus, Copepodes and, in smaller numbers, Ephemera (this fish is therefore a dangerous competitor with the species bred which have greater value); in the bream and in young fish, mainly Cladocerae and some Chydorides and Daphnia.

F. D.

1356 — **Eels and their Place of Breeding** (1). — SCHMIDT, J., in *Philosophical Transactions of the Royal Society of London*, Series B, Vol. 211, pp. 179-208, pl. 17-18 London, April 1922.

After reviewing previous experiments on the biology of the eel since 1904, the writer describes the results obtained in 1920-1921, on board the schooner "Dana". On these results and on the whole of the previous experimental work, M. SCHMIDT bases his reasons for reconstructing the sexual life of the eel as follows :—

During the autumn months, European eels (*Anguilla vulgaris*), which have reached the stage of "silvery eel," migrate to the Atlantic ocean and travel towards the south-west: the direction of their journey, the duration of which is still unknown, is towards a part of the western Atlantic situated to the north-east and north of the West Indies between 22° and 30° N. latitude and 48° and 65° W longitude. The central portion of the region is about 26° N and, consequently, about mid-way between the Leeward islands and the Bermudas. Here the eels breed; spawning starts at the beginning of spring and lasts until the summer. At first the larvae, from 7 to 15 mm. in length, remain at a depth of from 200 to 300 m. and grow rapidly; they reach 25 mm. in the early summer months, they then move towards the surface of the ocean and, helped by the move-

(1) See R. 1919, No. 1213. (Ed.)

ent of the mass of water towards the west, they begin their journey in the direction of the coast of Europe. During the first summer they are found as far as 50° W; the second summer, they grow to 50 or 55 mm. and go as far as the Central Atlantic; finally, in the third summer, they reach the limit of their growth (75 cm.) and gain the coastal waters of Europe.

During the autumn and winter they undergo the metamorphosis described by GRASSI and CALANDRUCCIO and pass from the leaf shaped stage to the blind stage.

SCHMIDT often found larvae of the American eel (*Anguilla rostrata*) mixed with those of *A. vulgaris* in the place of breeding; the migration of the two species in opposite directions might be due to two causes:— the one ethnological, the larval stage of *A. rostrata* only lasting one year the period being consequently insufficient for crossing the Atlantic; b) the second geographical, the centre of the breeding place of *A. rostrata* being slightly more to the west and south than that of *A. vulgaris*. E. F.

#### FARM ENGINEERING.

157 -- **Development of Electro-Agriculture in the Province of Bologna.** — I. Z., in *Agricoltura Bolognese*, Year XII, No. 4, p. 39, 8 figs. Bologna, April 15, 1922.

The writer, taking as his standpoint the report of A. TARCHETTI on certain trials made at the Vercelli Competition and leaving out of account heavy oil machines, observes that the funicular tractors most used in electric ploughing are the HOWARD fixed motor type, with horizontal cylinder motor on the carriage itself or on a separate carriage, and the FOWLER portable motor type, which works along the edge of the field. After referring to the great advance made in this kind of mechanical ploughing through the efforts of the "Ape" Society, the writer gives a practical demonstration to prove that such systems should be adopted as advantageous from an economic point of view.

Indeed, by using steam or internal combustion motors for ploughing, the cost per ha. fluctuates between 400 and 500 lire, whereas with electric power, at the contract prices of the Company, the maximum price is 85 lire, made up as follows:

Hire of the apparatus complete, including the services of a foreman,	
provided by the Company . . . . .	300 lire
5 workmen provided by the user . . . . .	75
Transport of the apparatus complete. . . . .	10
Total . . . . .	<u>385 lire</u>

As to the work performed by these machines, the writer gives the following figures, taken in actual practice: in 10 hours, with a single furrow plough, in dry soil, and at a depth of 35 to 45 cm., 6 to 7 sections are ploughed; with a double furrow, and at a depth of 20 to 30 cm., 8 to 10 sections are ploughed. In a rice field, with a single furrow 20 to 25 cm. deep, 9 to 10 sections (of 2080.44 m<sup>2</sup>) are ploughed.

Each complete machine-set includes a portable enclosed apparatus for transforming the electric current (15 000 to 220 volts), a horizontal-cylinder carriage, an electric-motor carriage, a plough balance and two anchor carriages with metal cable systems which, when attached to the cylinders, give the forward and backward movement to the plough.

G. D.

1358 - **Palm Oil as Motor Fuel.** — DAUTREBANDE, J., in *Revue de Chimie Industrielle*, Vol. XXXI, No. 369, pp. 268-269. Paris, September 1922.

Palm oil is derived from the pulp of the fruit of the palm ; it is composed of palmitin, olein, glycerine, with palmitic, stearic, oleic acid ; it melts at 35°, burns at 200° ; its calorific value is 9228 calories. The supply of palms is immense all over the African continent ; and the natives utilize only a tenth part. In 1912, 108 000 tons of oil were exported, including 78 000 tons from Nigeria. It gives an excellent fuel, leaving no residue ; it is possible to reach a temperature of 1800° and there is no risk of exploding owing to its high flash point. Transport is easy on account of its butyrous consistency ; its acidity does not corrode metals ; its unit price is less than that of other fuels in its country of origin ; 1 kg. of palm oil is equivalent to 1.200 kg. of coal. The only drawback, compared with crude oil, already largely used, is the high flashing point, which makes it difficult to light. Motors of 120 HP. are already working successfully with palm oil and it may be predicted that its use will soon become general.

A. de B.

1359 - **Experiments in Mechanical Flax Carding.** — PASSELÈGUE, G., in *Journal d'Agriculture pratique*, Year 86, Nos. 31, 34, 35, pp. 113-114 ; 117-178 ; 195-197 : 2 figs. Paris, August 5, 26, September 2, 1922.

Three types of machines for mechanical carding were entered at the last competition held at the Wallelot-sous-Beaumont industrial experiment Centre. The writer refers to the economic and industrial value of this system and describes in detail the three types of machines, which may briefly be classified, as :—

Type for carding	with combs
" " "	" rollers
" " "	" belts

with some modifications made by each maker. The programme of the competition prescribed the output, its quality, cost of carding, time taken, the cost of the machine and its amortization, as compared with similar standards on an equal quantity of raw material carded by hand. The writer concludes that whatever the decision of the judges may be, which will no doubt be very interesting, the fact remains very encouraging from the point of view of the development of machine work in agricultural industries.

G. D.

1360 — **Farm Garages.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Year 86, No. 30, pp. 94-99, 5 figs. Paris, July 29, 1922.

The writer describes all the qualities which should be found in garages intended for housing touring cars and small camions intended for agricultural use. He then gives detailed information on the subject of the dimensions suitable for country garages and he considers the case of a building constructed to hold a single vehicle, indicating the slight modifications which would be required in the original plan to adapt it to the requirements of several vehicles.

When building a garage in the country, the question of economy of space does not enter as is the case in towns, and the writer therefore recommends the following dimensions for a building to house a single vehicle:—

Total length of the building:— length of the vehicle + 2.40 m.

Total width of the building:— width of the vehicle + 2 m.

The writer remarks that the width may be slightly decreased if several vehicles arranged side by side are to be housed. In fact, if the given dimensions were applied in the case of several vehicles, there would be 2 m. free space between each pair of vehicles, which might be reduced to 1.40 m. Thus, supposing a touring car is about 4.20 m. in length with a width of 1.60 m., or that a small camion occupies a space of 5 m.  $\times$  2 m., and applying the dimensions of the former case, a garage 6.60 m. in length by 3.60 m. in width would be required.

It is recommended that the window and the entrance door should be on the same side as the front and rear of the vehicle.

The door should be at least 2.50 m. wide and about the same height, and if possible a sliding panel or falling panel door should be used. It should be so arranged that the vehicle enters the garage on one side and goes out by the exit door opposite. There should also be sufficient free space round the garage for entry and exit movement; this space should be 7 to 8 m. wide.

Regarding the height and architecture of the building, the writer leaves it to the taste of the builder, provided he tries, as far as possible, to make the building harmonise with the surroundings, having due regard to the importance both of such harmony and of economy of material.

G. D.

## RURAL ECONOMICS.

1361 — **Value of Animal Products in Relation to Crop Yield since 1919 in the United States.** — *Weather, Crops and Markets*, Vol. II, No. 11, pp. 220-221. Washington, D. C., Sept. 1922.

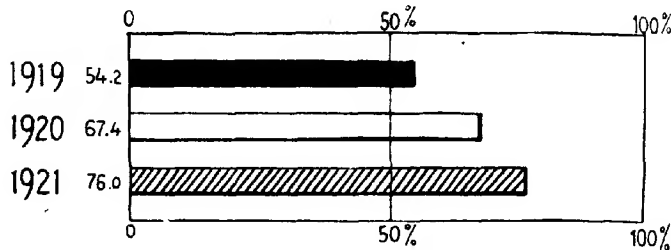
Under the normal price conditions of 1911-1913 the value of the animal products of the farm, including animals raised, was 59.7 % of the value of crops. By 1916 this value had decreased to 48.1 % and by 1917 to 43.4 %. Thereafter the ratio of the value of animal products to crops increased to 56.9 % in 1918, fell to 54.2 % in 1919, increased to 67.4 % in 1920, and to 76.0 % in 1921. As the value of animal products decreased

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between 1911-1913 and 1917 in relation to the value of crops, the value of crops in terms of animal products relatively increased from 167.4 % in 1911-1913 to 230.3 % in 1917.

The reason for these opposite tendencies was to be found in the fact that prices of crops increased under war conditions, before the United States became a participant, in a greater degree than the prices of animal products. After 1917, crops in relation to animal products lost in total value and in 1918 and 1919 were but little above their pre-war relative position. In 1920 the steep decline in the prices of crops gave to crop value the abnormally low position of 148.3 % relative to the value of animal products, because the prices of animal products were not so sensitive to the deflation movement as were the prices of crops. The prices of primary products, such as crops, are usually more sensitive to general influences than are the



Value of Animal Products as a Percentage of the Value of Crops, United States, 1919-1922.

prices of secondary products, such as animal products, which depend on crops for their production. The relative position of crop values declined in 1921 to 131.6 % of the value of animal products, the lowest point in the record of the U. S. Department of Agriculture which extends back to 1897.

The crop year beginning in 1919 included the peak of the price inflation movement which extended into the calendar year 1920. From 1914 up to and including the crop year 1919, the value of animal products in relation to the value of crops fell, and yet even in 1919 the value of the animal products of the farm was greater than the value of the crop production in 6 States. By 1921 crop prices had fallen so much further relatively than the prices of animal products that the list was expanded to 11 States by the addition of prominent crop producing States.

The change in Iowa's relative position from 1919 to 1921 is worthy of note. In 1919 its crop value was \$811 200 000 and the value of its animal products \$745 000 000, but in 1921 the crop value had fallen to \$282 600 000 while the value of animal products had fallen to \$475 700 00. The relative values of crops and animal products in Iowa shifted from an excess crop value of \$66 200 000 in 1919 to an excess value of animal pro-

ducts of \$ 193 100 000 in 1921. The value of animal products as a percentage of the value of crops in Iowa increased from 91.8 % in 1919 to 129.2 % in 1920 and to 168.3 % in 1921, whereas in the United States the movement was from 54.2 % in 1919 to 67.4 % in 1920 and to 76.0 % in 1921.

Computations similar to these have been made for 8 prominent crop producing States, the value of whose animal products on farms exceeded the crop value in 1921.

G. A. B.

1362 - **Plant Foods and human Foods in Germany.** - LEMMERMANN, O., in *Zeitschrift für Pflanzenernährung und Düngung*, Vol. I, No. 1, pp. 3-8. Leipzig, 1922.

Before the war, Germany produced 90 % of the vegetable elements and 67 % of the animal products : fat, meat, milk etc., which she required. German agriculture sufficed therefore for the feeding of 56 million inhabitants, and the remaining 12 million were supplied through importation, which was then very easy. The loss of 73,000 sq. km., or 13.6 % of her territory, has deprived Germany of :

19.7 % of her potato crops	13.72 % of her rye crops
17.20 % of her barley crops	12.60 % of her wheat crops

On the other hand, the population has diminished by 7.5 millions, or 10.8 %. Formerly there were 192 inhabitants per 100 ha. of arable land ; at present there are 202. Larger importation is therefore necessary, a very serious problem under present conditions. Production therefore must be increased, and this can be effected by the following means : culture and intensified improvement of soils — proper increase of manuring — development of plantations — selection of appropriate species — selection of seedlings — control of weeds — increase and improvement of forage — etc., but the most important questions are those connected with plant and animal diseases.

During the 25 years of peace from 1889-1890 to 1913, the yield per ha in Germany had increased as follows :

Bread cereals, 58 %.
Animal feed cereals, 52 %.
Potatoes, 56 %.
Rye from 11.8 to 19 qx. per ha.
Wheat from 15.1 to 23 qx. per ha.
Oats from 14.1 to 21.9 qx. per ha.
Potatoes from 101.8 to 158.6 qx. per ha.

The consumption of fertilisers rose from 16.2 million qx. in 1880 to 106.9 millions in 1913, an increase of 600 %. But the war has caused a great decrease. Nitrogen, from 635 000 tons consumed in 1913 of which 185 000 were artificial fertilisers, had fallen in 1919 to 305 000 tons, of which 115 000 were artificial. Phosphoric acid, from 1 060 000 tons, of which 350 000 were fertilisers, in 1913, had fallen as low as 430 000 tons in 1919, of which 230 000 tons were fertilisers.

Consequently, the yield per ha. has decreased as follows :

Bread cereals . . . . .	from 18.39 to 14.4 qx. per ha. or	46.3 %
Forage cereals . . . . .	" 19.3 " 15.0 " " " "	24.22 %
Potatoes . . . . .	" 142.0 " 98.0 " " " "	31 %

During the last 25 years (1885/89, 1908/12), food production had increased as follows :

Cereals from 16.3 million tons to 26 million tons . . . . .	46.3 %
Potatoes from 29.7 million tons to 44.2 million tons . . . . .	48.9 %

At the same time, the increase in the population, which rose from 48 to 64 millions (300 000 yearly), was inferior by 33% to that of food production.

In order to be completely independent of importation, Germany should increase her production by 50 %. According to MAYER, the maximum possible yield per ha. is as follows :

40 qx. of wheat and straw.
320 qx. of potatoes, including tops.
300 qx. of beets, including tops.

Further, there are still 3.5 million ha. of uncultivated land which could easily be rendered arable by artificial fertilisers. A. de B.

## AGRICULTURAL INDUSTRIES.

1363 — Types of Wine produced in the Trentino — CATONI, G. and GUSELOTTO, A., in *Giornale vinicolo italiano*, Year 48, No. 11, pp. 102-103. Casale-Monferrato, March 12, 1923.

The common red table wines, as sold, are the result of mixing various wines. They differ in character even in the same district. Two principal types can be distinguished :— wine made from "Pavara" and "Marzemino Padovano" or "Negrone" grapes, which is full-bodied but slightly acid and peculiar to the Val d'Adige, in the Rovereto zone, and that which is made from "Schiavone" or "Fossaro" grapes to which "Toroldico" or "Negrara" grapes have been added, which give an agreeable bouquet ; it is produced in the zone to the north of Trent.

The white table wines are mainly made from the "Vernaccia" and "Bianchetta" varieties. They have relatively little body and are defi-

(1) See R. March 1921, No. 302 ; R. July, 1921, No. 728 ; R. October 1921, No. 1012 ; in which the above-mentioned vines are described. For other information regarding the Trentino wine-making industry, see : — GRAMATICA, I., *l'industria enologica e i vini della Venezia tridentina*, in *Bollettino del Consiglio provinciale d'Agricoltura*, Year XXXV, No. 7-8, pp. 189-192, April 15-20, 1922 ; Dati analitici dei vini della Venezia Tridentina dell'ultimo ventennio, *Ibidem*, pp. 193-195 ; PANIZZA, T., *Della produzione e del commercio vinicolo nel Trentino* *Ibidem*, pp. 196-201. (Ed.)

ent in alcohol, but they have a pleasant flavour and are stimulant and smooth to the palate. "Riesling Italico", if it comes from favourably situated places, also enjoys a certain reputation in the market.

The better table wines are called "special wines". For the white kind, "Nosiola" and "Garganera" grapes are used; for the red wine, "Negrara", which in some places also furnishes a bottling wine. "Groppello" is also superior to the ordinary wines. But the wines of the Province most in request are "Marzemino" and "Teroldico". The former is alcoholic, delicate and slightly scented; the latter has a strong bouquet with a special aroma and a high alcoholic strength; it is rich in colouring matter and does very well as a wine for mixing and for bottling.

In the Sarca Valley (Dro), "Trebbiano" gives a scented wine of the Marsala kind, which is called "vino santo". From the "Nosiola" grape of the neighbourhood of lake Toblino and of the Pressano and Sorni (Lavis) hills an excellent wine called "natalino" or "vino santo" is made by the straw process. "Rhenish Riesling," "Traminer," "Bourgogne," "Cabernet," etc. from the Trentino are all excellent wines which are equal to the best vintages. The chemical composition of the principal wines mentioned is given in the following Table:—

*Chemical composition of the principal Trentino wines.*

Variety	Alcohol % of volume	Acidity	Acetic acid	Dry extract without sugar	Ash
Grammes per litre					
Red table wine (Rovereto zone) . . . . .	8.69	5.92	0.70	19.27	2.31
Red table wine (Mezolombardo zone) . . . . .	9.25	6.20	0.60	19.00	2.20
White "Vernaccia" . . . . .	8.90	6.52	0.79	16.00	1.50
"Riesling Italico" . . . . .	10.00	5.22	0.97	21.13	2.74
"Nosiola" . . . . .	10.93	5.30	0.64	16.32	1.52
"Groppello" . . . . .	18.64	9.24	0.26	23.54	2.74
"Negrara" . . . . .	11.71	5.40	0.62	20.27	2.09
"Marzemino" . . . . .	12.64	5.04	0.58	20.78	2.14
"Teroldico" . . . . .	12.47	6.00	0.72	22.61	2.22
"Vino santo" . . . . .	14.17	7.52	0.99	145.80 (total)	2.40

F. D.

1364 — The "Deferrage" of Wines (Report of the Governor General of Algeria). —

FOUGER, (Professeur à la Faculté des Sciences, Directeur du Laboratoire de Chimie agricole et industrielle, Alger) and BONNIER (Chimiste attaché au dit Laboratoire, in *Bulletin Agricole de l'Algérie, Tunisie-Maroc*, 2nd Series, Year 25, No. 2, pp. 33-43. Algiers, February, 1922.

Certain wines are known to show turbidity on exposure to the air, and this alteration is called *casse*. If these wines are poured from one vessel into another or left in an open receptacle they sooner or later become

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thick. This has been found to occur especially with white wines; these become colourless, turn milky and finally deposit a dirty white precipitate. In the case of red wines, the pigment is almost always precipitated, an iridescent film first appears on the surface, then the liquid becomes completely turbid, and after some hours, quite a large quantity may have become "*cassé*". The colouring matter becomes insoluble and turns more or less brown and floats upon an almost colourless liquid; later it falls to the bottom where it forms a purple precipitate. The other constituents of the wine also become altered and the vinous flavour disappears.

Two kinds of *casse*, the oxydasic and ferric are recognised. The former is due to the presence of soluble oxydasing ferments that introduce oxygen into the colouring matter, thus altering it so that it precipitates. This was discovered as long ago as 1894 by BOUFFARD who also suggested the means of remedying this trouble. The wine must be heated to 65° C., or else sulphur dioxide or bisulphites added, to render the oxydase inactive. At the present time the addition of sulphur dioxide and of its salts is general, and hence this wine disease no longer occurs. Ferric *casse* is much more serious; it also was reported by BOUFFARD, but somewhat earlier, viz., in 1887. He found the deposit contained as much as 10 % of iron (determined as ferrous-ferric oxides), and showed that the introduction of a ferrous salt is enough to cause a tendency in any wine to become turbid. BOUFFARD recognised that this disease is not checked by means sufficient to destroy the oxidase; heating is wholly ineffective and sulphur dioxide only succeeds in checking the alteration until it assumes considerable proportions. Tartaric acid however stops the change and masks the iron reaction. These statements were confirmed by LAGATI who persuaded the experts to adopt his opinion.

As FONZES-DIACON has shown, the white precipitate is almost entirely composed of basic ferric phosphate associated with a small amount of basic calcic phosphate and containing colouring matters. It is clear that the ferrous salts are oxidised by the air and transformed into ferric salts which combine with the phosphoric acid and precipitate it; the precipitate carries with it any foreign matters present. In red wines, the ferric salts can also react on the colouring matters.

The researches of A. GAUTIER have proved that these colouring substances are tannoids, i. e., compounds possessing the properties of tannin which can be divided into three groups: 1) a yellow pigment, very resistant to oxidation — 2) red pigments, or *œnolins*, some of which are soluble and others insoluble in water — 3) violet pigments, or *œnocyanins*, that appear to be ferric salts ionisable by *œnolins* or their amino-derivatives. *œnocyanins* occur largely in the black grapes of hot regions; in the presence of air, the ferrous ion becomes ferric by oxidation which causes precipitation of the tannoid substance. This is one of the causes of the clearness of old wines and of the instability of thick wines; it also brings about *casse bleue* or the blackening of wines. *œnocyanins* are however frequently not present in many red wines and in all white wines and in these cases, *casse blanche* occurs. The grapes used for making

these wines contain iron, but this only occurs in traces, or in the form of non ionised organic combinations, and thus has no power of reaction. The iron found in the white precipitate of these wines must undoubtedly have been introduced during the manufacturing process; it is derived from the iron used in wine-making plant, vats, beaters, pressers, pipes, etc. The acid of the must and wine attack the iron, the sulphur dioxide is still more active, especially if it is present in considerable quantities; 6-10 gm. per hectolitre should be sufficient, especially if the wine is also cooled if necessary. In order however to dispense with the refrigeration process, larger quantities are introduced with the result that the solvent power of the iron is increased and "*casse*" insues. Bisulphides, particularly sodium bisulphide, have a similar effect when used instead of sulphur dioxide. Owing to the presence of phosphates in the wine, most of the dissolved iron is precipitated as ferric phosphate. Wine should normally not contain more than 100-300 mgm. of phosphoric acid per litre, but now-a-days, ammonium phosphate is added to the must to promote alcoholic fermentation, as much as over 30 gm. per hectolitre being sometimes introduced; the results of this addition which encourages *casse blanche* (a milky appearance), have been reported by FONZES DIACON.

In order to prevent this form of *casse*, some wine-growers have limited or suppressed the use of iron or cast-iron apparatus and have adopted glazed ware receptacles.

Another way of attaining the same result consists in the introduction of organic acids that dissolve the basic ferric phosphate and thus mask its presence.

BOUFFARD recommended for this purpose the addition of tartaric acid, sometimes in considerable amounts, up to 500 gm. per hectolitre, but this process is no longer permitted. Citric acid may be used, which is even more effective, provided the dose be sufficient, but as the French regulations limit the amount to 50 gm. per hectolitre, the wines continue to become turbid.

A few unscrupulous dealers use a mixture of gelatine and ferrocyanide of potassium which possesses the property of precipitating the ferrous and ferric salts in the form of Prussian blue, which is afterwards removed by filtration, but in the presence of the organic salts of wine, this reaction is not complete. As fast as the organic acids become oxidised, the rest of the Prussian blue goes on precipitating, especially if the pseudo-clarifying agent is employed to excess. Blending with another wine also gives rise to *casse bleue*. It should also be observed that owing to the unstable nature of ferrocyanide, hydrocyanic acid may be produced, so that this treatment is dangerous.

Excellent results have however been obtained by the GRANDCHAMP-MAUVEZIN method. This consists in introducing oxygen into the wine by means of a Chamberland filter under a pressure of 4 atmospheres. The oxygen makes tiny bubbles forming a true emulsion which lasts from 2 to 3 days. The ferrous salts in this wine which is supersaturated with very finely-divided oxygen, become oxidised and are precipitated in the

form of ferric salts. All the precipitate settles if the wine is left undisturbed for three weeks, or it can be clarified quickly with gelatine. In the case of white wines, it is necessary also to add tannin; in red wines, the oxygen transforms the various tannoids into tannin. Apparatus is now made that allows several vats to be treated simultaneously. The treatment is simple and neither troublesome nor offensive, and has the additional merit of being economical. The amount of oxygen used is 1 m<sup>3</sup> per 200 hectolitres, and the present price in Algiers is 5 frs per 100 hectolitres. The analyses made by the authors have show that the greater part of the iron is removed by this method. Thus the iron content of a wine rich in iron fell from 52.5 to 29.5 mgm. per litre. In certain cases it is necessary to repeat the treatment. L. V.

1365 - Studies on Wine Mould and Mouldiness in Cellars in Italy. — CIFERRI, R., in *Rivista di Ampelografia*, Year III, No. 1, pp. 1-5; No. 2, pp. 17-22; No. 3, pp. 32-39; No. 4, pp. 49-51. Alba-Livorno, January-April, 1922.

There is very little literature on cellar mould and such as there is deals mainly with means of preventing it. The writer was therefore induced to undertake an experimental study of the subject including determination and count of cryptogams living in cellars, attempts to grow these moulds in wines and musts, under varied conditions, until the agents producing the mouldiness were identified by classifying their different odours, and, at the same time, experiments in an inverse direction to isolate the agents causing bad condition in wines, an examination of the conditions of the mouldiness, methods for treating affected wines.

By exposing Petri capsules to the air of the cellars, transplanting wood and cellar-wall cryptogams direct and then transplanting them to meat broth and agar in succession, the writer isolated: *Penicillium crustaceum* (L.) Fries (= *P. glaucum* Link.) — *P. roseum* Link. — *P. humicola* Oudem. — *Trichoderma lignorum* (Tode) Harz. — *Verticillium glaucum* Bonord. — *V. lateritium* Berk. — *Sterigmatocystis nigra* v. Thiegh. — *Spicaria elegans* (Corda) Harz. — *Aspergillus virens* Link. — *Trichothecium roseum* Link. — *T. candidum* — *Oospora nivea* (Fuck) Sacc. and Vogl. — *Cladosporium herbarum* (Pers.) Link. — *Coniosporium phacospermum* (Corda) Sacc. — *Torula monilioides* Corda var. *globosa* Ferrari. — *Helminthosporium obclavatum* Sacc. — *Stachybotrys alternans* Bonord. — *Epicoccum vulgare* Corda — *Rhizopus nigricans* Ehrenberg. — *Mucor mucedo* L. — *Rhacodium cellare* Pers. — *Ozonium lignorum* Fic.

While in the open air, the capsules being placed on the windows of the cellars, the number of the bacteria is more than double that of the fungi, in the cellars the fungi are more than twice as numerous as the bacteria. The maximum number of fungi is found where work is carried on in a busy place, the number of micro-organisms is 7-9 times greater than in quiet places.

The characteristic odour of mould is communicated to the wines by an Actinomycete isolated by the writer both from the air and from mouldy wine. It does not seem completely to coincide with any of the species

hitherto described, and the writer proposes to give it, for the time being, the name of *Streptothrix* (*Actinomyces*) *Sanninii* n. sp. It lives on the wood of the casks and if placed in contact with the wine or must, it does not develop, either because of the content in acidity or alcohol, or because it necessarily requires air for existence. As its odoriferous principle is much more soluble in alcohol than in water, the finer and more alcoholic the wine is, the sooner does it assume the mouldy smell and flavour.

Prof. SANNINO (*Trattato completo di enologia*, Turin, 1920, Vol. II, pp. 217 and sq.), distinguishes 4 different mould odours: 1) odour and taste of real mould; this is the most frequent and is treated with olive oil; 2) the "sapore di tempesta", which is both a mouldy odour and a very disagreeable flavour, at once styptic and bitter, attributed to the *Penicillium crustaceum*; the specific treatment is a fresh fermentation; 3) sour taste imparted to the wine through contact with staves attacked by mould and damp, which requires to be treated by a new fermentation; 4) dry taste; to be treated both by a new fermentation and by oil.

The first type of mouldy odour is generally attributed to the *Penicillium*; the writer's experiments are said to prove that this is a mistake, because this type is produced by the *Streptothrix Sanninii*, which he has isolated.

As means of prevention rinse the barrel with wine after first washing with water and close immediately afterwards; or wash with sulphurated wine; or sulphurate the barrel. Means of cure: treat the wine pure with olive oil (1 %). Arachis, cottonseed and sweet almond oils may, as the writer has observed, also be used for the same purpose, provided they are well purified, colza and rapeseed oils give rather good results; soy oil takes off the odour but not the mouldy taste; castor oil and raw or boiled linseed oil take off the odour but leave traces of their sickly flavour. In this respect, purified vaseline oil (colourless) is superior to all others; a treatment with as little as 0.5 % is sufficient; after use, if an emulsion is made with water, or alcohol, in which it is insoluble, the mouldy smell passes into the alcohol and the oil may be used again. On the other hand vaseline oils coloured artificially with aniline dyes should never be employed (1).

F. D.

1366 — Process of fermenting Maize Stalks for making Acetone, Alcohol and volatile Acids. — PETERSEN, W. H., FRED, E. B. and VERBULST, J. H., (Department of Agricultural Chemistry and Agricultural Bacteriology, University of Wisconsin), in *Journal of Industrial and Engineering Chemistry*, Vol. 13, No. 9, pp. 757-759. September, 1921.

The writers describe some fermentation experiments, made with *Bacillus acetoethylicum*, on a syrup of maize stalks, obtained by hydrolysis. The principal products obtained with this bacillus are acetone, ethylic alcohol, formic acid, acetic acid and carbonic acid gas.

(1) See R. February 1921, No. 199. (Ed.)



The biochemical relations between these products are very intimate; with a large production of acetone and alcohol there is a small yield of volatile acids, while with a large production of acids, the yield of acetone and alcohol is very small. These variations in the yield of products are caused by the reaction of the solution:— an alkaline reaction favours the production of acids, while an acid reaction favours the formation of alcohol and acetone. The writers prepared the fermentation solution by hydrolysing the stalks with dilute sulphuric acid. After hydrolysis they neutralized the excess acid with lime water. The insoluble residue is compressed and washed several times so as to extract as much sugar as possible from it.

The production of sugar capable of fermentation (composed mainly of xylose) depends on the quantity of acids, the volume of water, the duration of heating and on the pressure exerted during hydrolysis. The greatest yield of sugar (25-30 %) was obtained by heating for about 1 hour, under a pressure of 1.35 atmospheres, stalks mixed with 4 times their weight of water and with 8 % of their weight of acid.

The writers next made numerous experiments to determine which are the best conditions for bringing about the fermentation of the sugary solution, obtained by the hydrolysis of the stalks.

They began by preliminary experiments made in test tubes; they next made several series of fermentations in glass globes of about 1 litre capacity.

The fermentation was carefully followed and the fermentation solution was subjected to continual and close analysis.

From the analyses made it was concluded that an almost complete fermentation (90 % of sugar transformed) was obtained in a receptacle partly filled with coarse coal cinders.

The bacteria adhered well to these cinders, so that the whole culture was well distributed. By drawing off the fermented solution, at the end of fermentation, and by replacing it by fresh solution, taking great care not to disturb the layer of bacteria, the writers obtained a continuous and rapid fermentation.

In this process of fermentation, one of the most important points which has to be considered is the reaction of the medium. The acidity should be continually controlled and corrected when necessary with carbonate of lime. This neutralizes the excess of acidity which is produced during fermentation. By working in the best conditions, the writers obtained the following yield:— out of 100 parts by weight of stalks, they got 2.7 % by weight of acetone, 6.8 % by weight of alcohol and 3.4 % by weight of volatile acids.

In conclusion these experiments have shown that maize stalks can be used as raw material for the production of acetone, ethyl alcohol, and formic and acetic acids. The syrup obtained by the hydrolysis of maize stalks by means of dilute sulphuric acid, which contains mainly xylose, was rapidly and almost completely fermented by *Bacillus acetothyllicum*, and gave the products named above.

L. M.

- 1367 - Possibilities of the Plant Growth of the damp Tropical Areas for Supplying Materials for Liquid Fuel. — WHITFORD H. N. (Yale School of Forestry, Yale University, New Haven, Conn.) in the *Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 2. pp. 151-152. Washington, D. C., Feb. 1, 1922.

The future scarcity of the United States liquid fuel supply is now so apparent that the question of its early replacement has become a vital problem in national economics. A question involving the annual synthesis of some 4 900 000 000 gallons of a feasible gasoline substitute calls for the development of new ideas and new sources of energy. The one great source of energy is undoubtedly the sun and the question how can this source best be utilized arises. The obvious answer is to be seen in the growth of plant life from which, in turn, alcohol and other fuels may be made. The object of WHITFORD's article is to consider the possibilities of the tropics as a source of transformed solar energy capable of being utilized for the production of liquid fuel.

WOOD CROPS. — The raw material which is most abundant as a product of the energy of the sun is wood and the moist regions of all tropical countries still contain vast areas covered with virgin forests. Only in the tropics is growth so rapid that enormous crops of wood could be raised in a short time, in order that quantities of wood sufficient to supply a large alcohol-producing plant could be grown on a small area. Theoretically the moist tropics should have a double or even higher capacity to produce a given quantity of cellulose in a given time than temperate regions. This is actually the case in practice. Measurements of certain species of average hardwoods in the tropics indicate that they grow from three to five times as rapidly as such woods as cottonwood and white birch in United States climates. One acre of ground in the tropics can be made to yield as much timber in a given time as five or more acres in temperate regions, and, other things being equal, the cost of assembling this raw material at the factory would be greatly reduced.

BAMBOO CROPS. — Measurement made in the Philippines show that culms of certain species of bamboo will attain a height of from 66 to 82 feet in a single season; most of the growth takes place during three months. Two to three years are required for the culms to harden. Unfortunately little or nothing is known concerning the areas of bamboo in the tropics. In the eastern tropics it is found in pure stands or mixed with hardwoods over vast areas, while in the western tropics it is of very limited occurrence (1).

To depend on bamboo for paper pulp or for alcohol, planted crops must be raised. A rough estimate of the cost of bringing them to maturity (5 years) is about \$26 pr acre, but when once established and properly managed such plantings could be made to yield crops indefinitely. The yield per acre might perhaps be doubled and the acreage reduced one-half by selecting larger species. It is of interest that in the Philippines alone

(1) See R. 1922, No. 60. (Ed.)

TABLE I. — *Yield from small sized bamboo forests in the Philippines.*

Average yield per acre of dry material . . . . .	14 long tons
Average yield per acre of pulp . . . . .	3 short tons
Estimated average yield per acre of alcohol at 40 gallons to ton of pulp . . . . .	280 gal.
Acreage necessary to produce heat equivalent to 1920 production of gasoline in United States . . . . .	27,000.060 (42,200 sq. m.)
Amount of alcohol from this area . . . . .	7,500,000.000 gal.
Acreage necessary on 3 years' rotation . . . . .	81,000.990 (126,600 sq. m.)
Average cost of raw material per gallon of alcohol . . . . .	\$ .3 = 1/3

there are some 68 000 square miles of cut-over waste lands in grass and second growth forests that might be made available.

NIPA PALM. — While alcohol can be obtained from the inflorescence stalk of many palms, the nipa seems to be best adapted for its commercial production.

TABLE II. — *Yield and Cost of Alcohol from Nipa Palm.*

750 plants per ha. that can produce sap.
43 litres of sap per plant per season
32,250 litres of sap per ha.
6.5 per cent. of sap alcohol.
2096 litres of alcohol per ha. = about 210 gallons of alcohol per acre.
Cost of raw material per gallon of alcohol, 12 cents.

The annual production of nipa alcohol in the Philippines is nearly 3 000 000 gallons and only a small part of the entire area is under production, part of which is planted. The largest continuous area of nipa palm in the Philippines is about 22 000 acres.

No data are available for the total acreage. Much more extensive areas are known to exist in Borneo and part of the mangrove swamps of the tidewater throughout the Indo-Malay region. To make up the equivalent of 5 000 000 000 gallons of gasoline produced in the United States in 1920 would require an area of more than 50 000 square miles. If all the tidal swamps of the Indo-Malay tropics were planted with nipa the area available would probably fall far short of this.

WILD GRASSES. — About 40 per cent (48 000 square miles) of the de-forested area of the Philippines is covered with two wild grasses, viz. « cogon » (*Imperata exaltata*), known in other parts of the Malay regions as « langland grass » and « talahib » (*Saccharum spontaneum*). Experiments indicate that these grasses especially « cogon », compare very favorably with esparto grass in regard to yield of pulp, averaging about 45 per cent. by the soda process. The « cogon » is a grass 5 or 6 feet in height and is found in the drier soils, while « talahib », found in the damper soils, reaches a height of 9 to 10 feet. In some parts these grasses could be made to yield

two crops per year. Unfortunately, no figures are available for their average acre yield.

In other parts of the tropics there are large areas covered with grasses at might be suitable for paper making and possibly alcohol, among which may be mentioned the « caña brava » (*Cyperium sagittatum*), a large bamboo-like grass found throughout the moist tropical region of America. It is cultivated in many parts especially Columbia and Venezuela, for construction purposes.

AGRICULTURAL CROPS. — Reliable average statistics concerning the cultivation in tropical regions of strictly staple agricultural crops are not available. The figures given below are therefore subject to correction as additional information becomes known.

It is the author's opinion that of all agricultural crops cassava is one of the most promising to investigate for the production of immense quantities of alcohol, since with improved methods of cultivation the yield per acre could undoubtedly be considerably increased.

TABLE III. — *Cost and yields of cassava.*

Yield per acre of roots . . . . .	10 tons
Cost of raw material per ton . . . . .	5 8
Per ton yield of alcohol . . . . .	30 gal.
Per acre yield of alcohol . . . . .	300 gal.
Cost of raw material per gallon of alcohol . . . . .	16 $\frac{2}{3}$ cts.
Average necessary to raise the equivalent of the 1920 production of alcohol in U. S. . . . .	27 000 000
(about 40,000 sq. m.).	

Maize is extensively grown in the tropics but only exported to a slight extent.

Possibly two crops per year might be raised with a production of 40 bushels; the same amount of maize would be raised in the tropics as in the United States, on an area one-half the size. This high rate of production would seem somewhat problematic in view of various adverse factors.

In the tropics the *rice* crop usually takes four to five months to mature. Where the rainfall is sufficient it can be grown without irrigation. It is probable that if the proper amount of soil moisture could be had, say by irrigation, two crops per year could be obtained.

While *cotton* is of tropical origin, most of the world's production comes from the North Temperate region. Continuous rainfall and much cloud is detrimental to the growth of cotton; hence very moist tropical regions are not suited to its production. In regions subject to drought irrigation is necessary. While there are many extensive regions in the drier parts of the tropics that could be made to yield larger amounts than they are now doing, it is probable that the production per acre in the tropics cannot be increased over that of the best portions of the United States cotton belt.

*Sugar cane* is essentially a perennial crop. Black strap molasses from refining sugar is the present source of most of the United States industrial alcohol.

The above is an incomplete review of the possibilities of the tropics to produce crops of foodstuffs and wood capable of application to the manufacture of cellulose and alcohol. Little or nothing is known of the possibilities of many of the wild forest products for the manufacture of products suitable for paper making, or the amount of alcohol that they will yield by distillation or by fermentation processes. Until the fast growing species suitable for these purposes are found it is useless to talk about producing them on a large scale. The few figures given serve merely to indicate the possibilities and are based on admittedly limited data.

The evidence, however, is conclusive that the tropical sun has the power to store up more energy in the form of cellulose in a given time than the temperate sun, and if this energy is in a utilizable form it is left to human ingenuity to overcome the difficulties of finding the means for its profitable application.

G. A. B.

1368 -- **The Sweetness of Cane and Beet Sugars and their Value for Jam Making.**

OGILVIE, J. P., in *Chemical Industry*, Vol. XI, No. 16, pp. 343-345. London, August 31, 1922.

At present there are in the market two qualities of cane and beet sugar:— 1) refined sugars; 2) unrefined sugars. The former are obtained by dissolving crude sugars a second time and by treating them with animal charcoal to purify them and finally letting them recrystallize. The sugar so obtained is formed of saccharose almost chemically pure (99.95 %) and it is difficult to determine the impurities which it contains. Derivation from cane or beetroot makes no difference in the sweetness of the sugar or in its value for making jam. Unrefined sugars are obtained by filtering the syrup and by washing it with water and steam in centrifring apparatus. The best unrefined sugars contain 99.5 % of saccharose. The difference between refined and unrefined sugars consists in the presence of reducing sugars, ash and non-sugary organic substances. Unrefined sugars derived from the sugarcane have a slightly acid reaction. They contain reducing sugars and have an agreeable smell derived from the syrup. Sugars derived from beetroot do not contain any reducing sugar and are often slightly alkaline. Sugars of inferior quality may retain the disagreeable odour which is characteristic of beetroot syrup.

Many merchants and physiologists think that cane sugar, though containing the same percentage of saccharose as beet sugar, or even less, is sweeter than beet sugar. The writer explains the difference by the fact that the sensation of sweetness, felt by certain nerves, is affected by the sensations of acidity, alkalinity, etc. which are felt simultaneously by other nerves. Thus traces of acidity increase the sensation of sweetness and traces of alkalinity decrease it. For example, Demerara sugar, obtained directly from sugar-cane syrup which contains a certain amount of acids, seems sweeter than refined sugar; it contains, however, 4 % less saccharose. The aromatic substances in sugar have also a great influence. Consequently it is suggested that a small quantity of vegetable acids and aromatic substances should be added to sugar to increase its sweetness.

[1367-1369]

The value of sugar for making jam depends on several conditions, the principal of which are as follows:— 1) absence of micro-organisms capable of causing fermentation; 2) reaction of the sugar, which should be neutral or slightly acid. Formerly refined sugars only were used in making jam, but it is now known that when refined sugars are treated with steam, bacteria in them are killed. As regards reaction, beet sugars were always trusted, but these sugars are now obtained in a high degree of purity and are quite satisfactory for jam making.

Having analysed 2000 jams, G. W. SHAW concludes that those prepared with beet sugar are identical with those prepared with cane sugar. Further, he found 99.7 % of saccharose in beet sugar and 99.8 % in cane sugar.

A. d. B.

99 - **Bread-making with Manioc Flour** (1). — ALVES DE LIMA, A. M. (Presidente da Companhia Guatapará), in *Revista da Sociedade Rural Brasileira*, No. XXVI, pp. 429. Rio de Janeiro, August 1922.

In Brazil manioc flour cost in 1922 400 reis (about 11d. at par) per kg.; wheat flour, almost all imported, cost double. Hence much research and experimental work was undertaken with the object of utilizing manioc flour for bread-making; so far however the results obtained have not been satisfactory. For this reason the writer considered it worth while to call attention to the method used most successfully by the "Companhia Guatapará", which manufactures manioc flour and makes bread with it.

Two kg. of manioc flour is kneaded with the requisite amount of water and allowed to remain in the kneading-trough for an hour. Any yeast, or preferably brewer's yeast, is mixed with the dough. 2 kg. of wheat flour is kneaded separately, and this dough is mixed with the first and the whole is carefully worked up. The quantity of water to be used is the same as for 4 kg. of pure wheat flour; as the manioc flour is the more absorbent, after previously measuring the water, only that which is left when the manioc flour has been kneaded is used for kneading the wheat flour.

R. D.

100 - **Production of Olive Oil in Greece** (2). — *L'Economiste d'Athènes*, Year I, No. 29, pp. 458-459. Athens, 2-15 Aug. 1922.

The production of oil in 1920 was most abundant, amounting to about 1,000,000 tons. This quantity may be divided into three classes:—

1) *Superfine oils*, including oils of from 1 to 2 degrees of acidity and representing a very small portion of the total production. They are produced in the Ionian islands, Mytilene and Arvali.

2) *Table oils*, including Greek olive oils of from 3 to 7 degrees of acidity, and representing about  $\frac{2}{3}$  of the total production. They come from the Peloponnesus (Kranidi, Astros, Calamata, Cythion, etc.), Mytilene, and the Provinces of Crete and the Ionian islands.

(1) See R. Oct. 1922, No. 1107. (Ed.)

(2) See R. Oct. 1922, No. 1090. (Ed.)

3) *Industrial oils.* — These oils have from 8 to 25 degrees of acidity and represent about the remaining two fifths of the total production of Greece. They are produced in Crete (Kanea, Rethymnos), at Mytilene and in some Provinces of Old Greece. These oils can be used in industry and soap-works. The export of these 3 classes of oil began on May 15 1921 after permission of the Ministry of Revictualling and has amounted to 7 million *okas* (1 *oka* = 1.25 kg.). The prices of oils during the year 1921 have undergone great fluctuations due on the one hand to forecast of a short production for the current year, forecasts which have been realized (for the crop only amounted to about 40 000 tons) and, on the other hand, to the heavy fall in the Greek exchange. G. A. B.

1371 — *The Grape Syrups and Preserve Industry.* — BORCHI M., in *Giornale di Chimica industriale ed applicata*, Vol. IV, No. 9, pp. 396-402. Milan, September 1922.

With a view to the increased development of the vine growing industry, an attempt has been made for some time past, not only on the part of the trade, but also by economists and persons interested in hygiene, to use grapes for other purposes viz., the manufacture of sweet substances containing no alcohol: must, syrup, preserve, etc.

Whereas alcohol is not a true food and is to a certain extent injurious the grape-sugar which is the chief constituent of must has a high nutritive value and from the health standpoint is superior to beet and cane sugars, for in the must, it is associated with ferments that facilitate its assimilation.

The composition of must is as follows: glucose (120 to 240 gm. per litre), tartaric acid, malic acid, tannins, other acid and neutral organic salts (5 to 15 gm. per litre), albuminoids, lecithin, gums (8 to 14 gm. per litre).

From concentrated musts, the lecithins and albuminoids are removed, being insoluble compounds. In concentrated syrups, the sugar content is double and three times as high, or even higher, but the nutritive substances are for the most part lost.

When concentration is brought about by the agency of heat, the ferments and aroma are destroyed. The prevention of this loss is the subject of much experimental work now in progress.

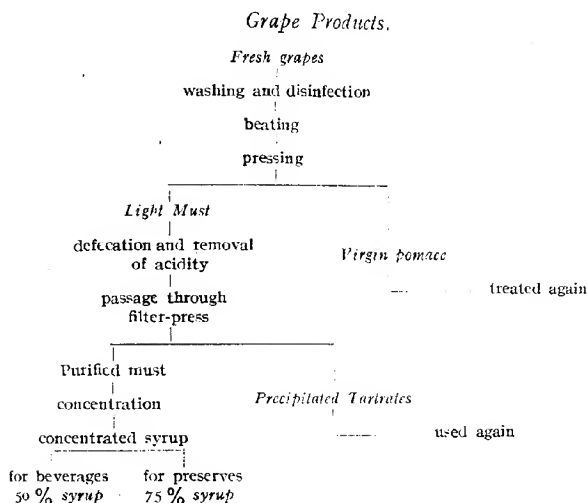
The home-manufacture of must and its products dates from remote antiquity. In Emilia especially, it is the custom to prepare the "sughit" (juice) by reducing the must to  $\frac{1}{3}$  and adding flour. In other districts, some of the acidity is neutralised by the introduction of marble-powder or chalk.

There are no industrial establishments of any size which are engaged solely with the production of concentrated musts.

The author gives the general scheme of such an establishment and describes the various stages of the industrial process. First the must is obtained. The grapes selected are weighed and put into mechanical beaters and presses. The must may be treated in 2 different ways. For the preparation of a simple or sterilised syrup at the lowest possible tem-

perature, it is cleared by filtration and bottled. In making concentrated products, the must should be freed from acidity by chemical reagents (calcium carbonate, etc.), then passed through a filter-press and concentrated in a vacuum at 50°-60° C. The concentrated syrup, which resembles grape-jelly, can be sold as it is, or used as a base for special syrups preserves, etc.

Calculating the must yield at 50 %, one quintal of grapes of an average of 18° (glucometric) yields 24 kg. of semi-concentrated syrup with 50 % glucose, or 16 kg. of concentrated syrup with 75 %.



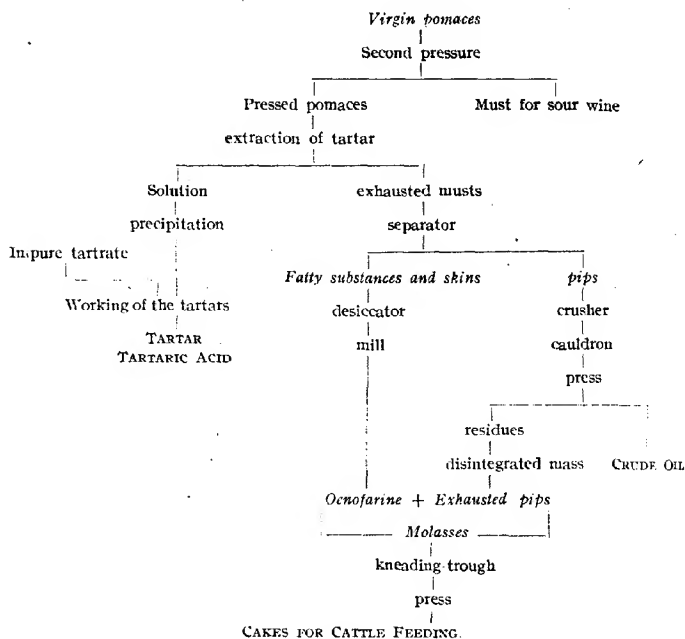
*Working up the grapes.* — The residue after pounding, is composed of unfermented pomace containing a certain amount of must. The pomace can be distilled with the addition of a little fresh must, to make sour wines, or for the extraction of alcohol. The pomaces resulting from the two processes are composed of 28 % pulp, 48 % skins, and 24 % pips. The first by-product is cream of tartar; this is extracted with boiling water, in which it crystallises. The cream of tartar present in pomaces ranges from 1.5 % to 5 %.

The pips are separated mechanically from the pomace; they contain 14 to 20 % oil, 9 to 12 % carbohydrates and 10 to 11 % nitrogenous matters. They can be worked over again to yield crude oil for lighting and soap-making; this oil, if refined can be used for human food, and cakes made from it are given to stock. A colouring matter, oenocyanin, is obtained from the grape-skins. The pips and skins of grapes are ground



to make cakes and can also be used as a fertiliser either alone or preferably mixed with dung. The stalks may be employed as fuel, and yield an ash containing 40 % of potash.

*Working up of by-products.*



The grape industry therefore furnishes a great variety of products and none of the material is wasted. The working up of the by-products is technically more complicated than the manufacture of the chief products. A well-organised establishment is absolutely necessary to deal with all the branches of the work. Owing to the present variable condition of the markets, it is impossible to develop on a large scale, but the new industry presents itself under the most auspicious conditions, for its sole object is both hygienic and social, viz. the substitution for alcohol of products having great nutritive value which could in addition prove a source of considerable wealth, having regard to the fact that exportation would be an easy matter.

A. de B.

372 — **Dairy Production in Czecho-Slovakia** (1). — I. CHOCENSKY, Ch. (Chef de l'Institut lactologique), La production laitière en Tchécoslovaquie. — II. L'Industrie du lait en Tchécoslovaquie. — III. Le contrôle de l'utilité des animaux domestiques à l'étable. *Bulletin du Ministère de l'Agriculture de la République Tchécoslovaque*, Year III, No. 4, pp. 25-28. Prague, Oct. 1, 1922.

I. — According to statistics for 1911, there were 2 279 670 dairy cows in the Czecho-Slovakian Republic. According to estimated figures of the December 31, 1920 the number had fallen to 1 984 457.

Before the war there were 62 Czech co-operative dairies in the Republic in which 19 million litres of milk a year were used and 23 German co-operative dairies which used 26 million litres of milk a year. There were besides 392 dairies belonging to owners of large estates, to large milk producers and to Czech dairy farms dealing with milk production, on which 39 million litres of milk were produced and 22 similar German establishments with a production of 8 500 000 litres of milk. Allowing for the milk directly consumed and the milk used in the dairies, there remains an excess of about 376 million litres which were utilized in the farms, faulty methods being often followed. The national production fully suffices for home consumption which is estimated at 190 litres per head per annum in the country and 130 litres in the towns.

Before the war, the annual production of cheese was 24 351 qx. in Czech countries and 52 000 qx. in Slovakia. In the former the annual consumption exceeded the production by 14 000 qx., but in Slovakia there was a surplus production which compensated for the deficit. The production of butter was sufficient to cover the consumption, estimated at 5 kg. per head per annum.

In Slovakia the consumption of butter is 3.75 kg. per head per annum; in place of butter a thick small cheese called "brynza" is used.

The writer recommends:— development of dairy cow breeding, national manufacture dairy products with a view to exportation, and specially the establishment of co-operative dairies and markets for collecting milk.

II. — With the exception of the agricultural co-operative dairy of roja and the co-operative dairies of Bohnšovce, Louny, Tábor and Kolín, the largest and best managed dairies in Bohemia belong to private owners, as an example mention may be made of the Radlice-Smichov dairy, which, before the war, used 75 000 litres of milk and has branches (called "complementary") which in times of emergency sent properly chilled milk to Prague and at normal times converted it into dairy products. This dairy manufactures milk-sugar (exported to England and Holland) from whey and the condiment well known under the name of "šlša".

The writer recommends the establishment of similar agricultural undertakings in Bohemia, at Prague and Plzeň; further, at least 180 co-operative dairies should be started producing at least 100 litres of milk

(1) See R. Dec. 1921, No. 1191. (Ed.)

daily and an establishment for making soft white cheese and small cheeses.

In Moravia there are many co-operative dairies (115 Czech, 29 German) which undertake successfully all branches of the dairy industry, but especially the production of superior quality cheeses.

Silesia has 17 co-operative dairies, a number which ought to be increased.

III. — In Bohemia, control of dairy production (and of the corresponding consumption of forage) was introduced in 1905 by 41 control associations; the number of controlled cows reached 10 262 in 1914. In Moravia, such control was introduced in 1909 and in Silesia in 1913.

F. D.

1373 - Condition of the Dairy Industry in Hungary. — KRETSCHMER, K. (Budapest), in *Molkerei-Zeitung*, Year XXXVI, No. 69, p. 1557. Hildesheim, Sept. 12, 1922.

In Hungary the breeding of dairy cows fell off during the war and during the first following years, especially as regards the quality of the animals bred; but it is now increasing and improving. In small centres and in the country, central stations have been established for collecting milk, which arrange for its immediate refrigeration and consignment to Budapest in refrigerated wagons. At Budapest the distribution of milk is carried out by two large central dairies. Each of them distributed 70 000 litres in 1921, as against 140 000 litres in 1914.

In spite of this organisation and although Hungary produces more milk than is required for home consumption, difficulties of various kinds (of transport, insufficient co-operation, etc.) cause the requirements of large centres, and especially of Budapest, to be barely satisfied. A fairly large quantity of unsold milk remains therefore in the country places, which serves to supply the acidified milk industries. As these have a surplus production they supply mainly for export.

The "Terra, Milchprodukten-Industrie A. G." Company was formed at Budapest for the manufacture of acidified milk and for the export of the produce. The numerous establishments belonging to it in the country collect the sour milk which is then sent to the central establishment in Budapest where it is prepared according to its quality. Most of the Hungarian coagulated sour milk is manufactured by this Company.

Another of its products, which is exported to many countries is butter-milk curdled and dried ("Trockenquarg") the quality of which is very nearly equal to casein of French manufacture. The manufacture of cheese from sour milk is still only done on a small scale: the "Quärgel" are mainly made in summer, especially for export; in winter they are also used for home consumption. Recently methods of rapid ripening have been adopted and the manufacture of soft and hard cheeses has been started and rapid progress has been made. Of the former, the Camembert type is mainly made. Sheep's milk is also much used.

In short, it may be said that the production of milk has decreased in Hungary compared with the pre-war period, but that the dairy industry has made progress.

F. D.

1374 — **Scientific and economical Study on Milk Refrigeration with Drum Refrigerators.** — ROSSI, F., in *Annali dell'Istituto sperimentale di Casificio in Lodi*, Vol. 1, No. 4, pp. 141-150. Lodi, September 1922.

A comparative study of the methods of milk refrigeration most in use : 1) with water ; 2) with water and ice ; 3) with water, ice and salt. The refrigerator used in this experiment had a drum and was capable of freezing 400-450 litres of milk per hour.

This type has 3 essential parts :

1) A rectangular section reservoir with an opening in the bottom closed by a special tap.

2) Double tubular surface placed vertically under the reservoir.

3) Cylinder or drum, inside which a tube or spiral runs lengthwise, and of which one of the ends communicates with the tube for drawing off the water, and the other, by means of a pipe end, with the inner refrigerating surface.

The milk passes from the reservoir through a perforated hopper whence it descends in a thin sheet on to the two sides of the tubular surface, then on to the outer surface of the drum and into the recipient placed below.

The writer's observations, which he has set out in 3 tables, show that in refrigerating, the milk passed from initial temperatures of 33-34° C to 15° C (on an average) with water — 7.8 to 10° with ice — 8.3 to 10.2° with water, ice and salt.

As regards the increased degree of preservation acquired, the initial acidity (7.2-7.8 Soxhlet %) had passed, 16 hours after refrigeration, from 0.2 to 0.4 %, whereas for the same milk not refrigerated, it had passed from 0.6 to 2.2 %.

This result is confirmed by the reductase test : the quicker the milk has been refrigerated, the longer the time necessary for the decoloration of the methyl blue.

Generally, the greatest falls in temperature took place when the pressure of the milk falling into the recipient decreased ; consequently to ensure uniform refrigeration, the flow from the reservoir should be maintained at a constant speed.

The best results in refrigeration are obtained by completely filling the drum with finely crushed ice ; the temperature of the milk was thus reduced to 7 % ; it therefore cooled better than with the water, rough ice and salt mixture.

On the assumption that a workman, who is paid fcs. 2.20 per hour, only looks after the changing and emptying of the apparatus, the cost of refrigeration with water only would be 0.55 lire per quintal of milk ; with water and ice, which costs 14 lire the quintal, 2 lire per quintal ; and with water, ice and common salt which costs 0.14 lire per kg. 3 lire per quintal of milk refrigerated at about 8° C.

F. D.

[1372-1374]